NASA

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# Earth Resources
A Continuing
Bibliography
with Indexes

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NASA SP-7041 (24)

# EARTH RESOURCES

## A Continuing Bibliography
## With Indexes
## Issue 24

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between October 1, 1979 and December 31, 1979 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

Scientific and Technical Information Branch 1980
**National Aeronautics and Space Administration**
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# INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumention on orbiting spacecraft or on aircraft.

This literature survey lists 345 reports, articles, and other documents announced between October 1 and December 31, 1979 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

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# AVAILABILITY OF CITED PUBLICATIONS

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies of accessions are available at $6.00 per document up to a maximum of 20 pages. The charge for each additional page is $0.25. Microfiche (1) of documents announced in *IAA* are available at the rate of $2.50 per microfiche on demand, and at the rate of $1.10 per microfiche for standing orders for all *IAA* microfiche. The price for the *IAA* microfiche by category is available at the rate of $1.25 per microfiche plus a $1.00 service charge per category per issue. Microfiche of all the current AIAA Meeting Papers are available on a standing order basis at the rate of $1.35 per microfiche.

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Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

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Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

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**N78-10497*#** National Academy of Sciences - National Research Council, Washington, D. C. Committee on Remote Sensing Programs for Earth Resource Surveys.
**MICROWAVE REMOTE SENSING FROM SPACE FOR EARTH RESOURCE SURVEYS**
1977 141 p refs
(Contract NASw-3043)
(NASA-CR-157891) Avail: NTIS HC A07/MF A01 CSCL 05B

The concepts of radar remote sensing and microwave radiometry are discussed and their utility in earth resource sensing is examined. The direct relationship between the character of the remotely sensed data and the level of decision making for which the data are appropriate is considered. Applications of active and a passive microwave sensing covered include hydrology, land use, mapping, vegetation classification, environmental monitoring, coastal features and processes, geology, and ice and snow. Approved and proposed microwave sensors are described and the use of space shuttle as a development platform is evaluated. A.R.H.

# TYPICAL CITATION AND ABSTRACT FROM *IAA*

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A79-11385 * # A comparison of photointerpretive and digital production methods for four key remote sensing-based information products. L. F. Eastwood, Jr., T. R. Hays, R. J. Ballard, and G. G. Crnkovich (Washington University, St. Louis, Mo.). In: Conference on the Economics of Remote Sensing Information Systems, 1st, San Jose, Calif., January 19-21, 1977, Proceedings.
San Jose, Calif., San Jose State University, 1977, p. 213-228. 10 refs.
Contract No. NAS5-20680.

This paper evaluates the costs of producing four remote sensing-based information products: timber volume estimate tables, Level II land use/land cover maps, soil maps, and vegetative cover maps. Two production methods for each product are evaluated, one is based on digital processing of satellite data, and the other on conventional photointerpretation of aircraft data. For each product, a comparison is conducted of the two strategies' production costs (including data acquisition, 'ground truthing', interpretation, compilation, and printing charges) and their performance (as measured by accuracy and timeliness). Each of the production methods reviewed has been demonstrated - either operationally or experimentally - and the costs, timeliness and other performance estimates presented are based on observations made in practice. The results show that for these products, satellite-based production results in significant cost and timeliness improvements at the cost of a loss in accuracy. (Author)

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# EARTH RESOURCES

## A Continuing Bibliography (Issue 24)

JANUARY 1980

## 01
## AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

**A79-44143** # **Experimental evaluation of the possibility of using the method of hyperparallelepiped for automatic decoding aerospace information (Eksperimental'naia otsenka vozmozhnosti ispol'zovaniia metoda giperparallelepipeda dlia avtomatizirovannogo deshifrirovaniia aerokosmicheskoi informatsii).** Iu. M. Benilov and Z. K. Fedotova. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 161-167. In Russian.

**A79-44145** # **Automatic processing of multispectral video information for crop recognition (Avtomatizirovannaia obrabotka mnogospektral'noi videoinformatsii v tseliakh raspoznavaniia sel'skokhoziaistvennykh kul'tur).** V. I. Borisenko, I. A. Labutina, and L. S. Chesalin. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 176-184. 5 refs. In Russian.

**A79-44395** # **Normalization of radiance data for studying crop spectra over time with a mobile field spectro-radiometer.** E. J. Brach (Agriculture Canada, Engineering Research Service, Canada), A. R. Mack (Agriculture Canada, Soil Research Institute, Canada), and V. R. Rao. *Canadian Journal of Remote Sensing,* vol. 5, May 1979, p. 33-42. 8 refs. Research supported by the National Research Council.

**A79-46502** # **Radiation characteristics of vegetation covers in the microwave range (Radiatsionnye kharakteristiki rastitel'nykh pokrovov v SVCh diapazone).** A. E. Basharinov, E. N. Zotova, M. I. Naumov, and A. A. Chukhlantsev. *Radiotekhnika,* vol. 34, May 1979, p. 16-24. 26 refs. In Russian.

The paper surveys mathematical models and experimental data pertaining to the radio scattering and thermal emission characteristics of vegetation covers in agricultural areas. The use of microwave remote sensing techniques for the purposes of crop inventory and vegetation monitoring is discussed. B.J.

**A79-46582** * **The influence of false color infrared display on training field identification.** W. A. Coberly (Tulsa, University, Tulsa, Okla.), J. D. Tubbs (Arkansas, University, Fayetteville, Ark.), and P. L. Odell (Texas, University, Dallas, Tex.). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 225-236. 8 ref. Grant No. NGL-44-004-026.

The overall success of large-scale crop inventories of agricultural regions using Landsat multispectral scanner data is highly dependent upon the labeling of training data by analyst/photointerpreters. The principal analyst tool in labeling training data is a false color infrared composite of Landsat bands 4, 5, and 7. In this paper, this color display is investigated and its influence upon classification errors is partially determined. (Author)

**A79-46583** * **Monitoring corn and soybean crop development with hand-held radiometer spectral data.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.), J. H. Elgin, Jr., J. E. McMurtrey, III (U.S. Department of Agriculture, Field Crops Laboratory, Beltsville, Md.), and C. J. Fan (Morgan State University, Baltimore, Md.). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 237-248. 22 refs.

**A79-46584** **The use of polarized panchromatic and false-color infrared film in the monitoring of soil surface moisture.** P. J. Curran (Bristol, University, Bristol, England). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 249-266. 27 refs. Natural Environment Research Council Grant No. GR3/1481.

**A79-46585** **Grain yield prediction - Extending the stress-degree-day approach to accommodate climatic variability.** S. B. Idso, J. L. Hatfield, R. D. Jackson, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 267-273.

The stress-degree day method of plant water stress assessment for the prediction of grain crop yields is extended to take into account climatic variability. The stress-degree day approach, which is based on a sum of the daily differences between crop canopy temperatures and air temperatures above the crop, is combined with the classical growing-degree day parameter, which is based on the differences between the mean air temperature and a base temperature below which physiological activity is assumed to be inhibited. The combined parameters, taken over the grain filling period with allowances made for light and degree day conditions prior to the emergence of grain heads, are found to predict equally well the yields of wheat crops growing in Phoenix, Arizona and Davis, California. The extended approach also allows the prediction of the time of the cessation of growth and of final yields at an early stage of crop development. A.L.W.

**A79-46586** * **Equivalence of airborne and ground-acquired wheat canopy temperatures.** J. P. Millard (NASA, Ames Research

Center, Moffett Field, Calif.), J. L. Hatfield (California, University, Davis, Calif.), and R. C. Goettelman (LFE Corp., Richmond, Calif.). *Remote Sensing of Environment*, vol. 8, Aug. 1979, p. 273-275. 5 refs.

The relationship between airborne and ground-based measurements of soil and crop canopy temperatures is investigated for a partial crop canopy. Daily ground-based measurements using a wide-field-of-view radiometer oriented towards the nadir at a height of 1.5 m and airborne thermal imagery at two-week intervals were obtained throughout the entire growing season of a stand of wheat. When corrected for atmospheric effects, the airborne measurements were found to be virtually identical to ground-based measurements, with a regression line slope of 0.985, a standard deviation of 1.8 C and a correlation coefficient of 0.97. A.L.W.

**A79-47556** **Parameters of cotton cultivation from infrared aerial photography.** T. J. Henneberry, L. A. Bariola (U.S. Department of Agriculture, Western Cotton Research Laboratory, Phoenix, Ariz.), W. G. Hart, M. R. Davis, S. J. Ingle (U.S. Department of Agriculture, Science and Education Administration, Weslaco, Tex.), D. L. Kittock (U.S. Department of Agriculture, Cotton Research Center, Phoenix, Ariz.), and H. F. Arle (Arizona, University, Phoenix, Ariz.). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Aug. 1979, p. 1129-1133. 8 refs.

Aerial infrared photography was demonstrated to be effective in early determination of the effectiveness of plant growth regulators applied to remove late-season fruiting forms of cotton, Gossypium spp., and associated diapause larvae of the pink bollworm, Pectinophora gossypiella (Saunders). In addition, response to fertilizer, differences in cultivars, and disease were readily identified. (Author)

**A79-47557** **Forest type mapping from Landsat digital data.** J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Aug. 1979, p. 1135-1144. 18 refs.

The results of a computer classification of three forest areas in Quebec are examined. The first, a study on Anticosti Island, showed that it was possible to distinguish mature and overmature balsam fir stands, black spruce stands, level of regeneration after cut-overs or fires, and damage caused by an insect epidemic. The other two studies covered larger areas with a more complex topography and vegetation cover. It is shown that by using unsupervised digital classifications, it was generally possible to map hardwood, mixed-wood, and two or three types of softwood stands depending on the area. Other factors which play the largest role in soft-wood class distribution are age and density, and percent and exposure of the slope. It is noted that it was impossible to separate regeneration and mature stands within mixed or hardwood forest types. It is concluded that the accuracy of a computer classification depends on a number of factors specific to each study but particularly on the type of terrain to be mapped. M.E.P.

**A79-47558** * **Reflectance of varying mixtures of a clay soil and sand.** A. H. Gerbermann (U.S. Department of Agriculture, Weslaco, Tex.) and D. D. Neher (Texas A & I University, Kingsville, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Aug. 1979, p. 1145-1150. 15 refs. NASA Order S-70251-AG; NASA Task 3.

**A79-48459** * **Detecting transition in agricultural systems.** P. J. Neary (Columbia University, New York, N.Y.) and J. C. Coiner (Hunter College, New York, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 477-482. Grant No. NsG-5080. (ASP 79-182)

Remote sensing of agricultural phenomena has been largely concentrated on analysis of agriculture at the field level. Concern has been to identify crop status, crop condition, and crop distribution, all of which are spatially analyzed on a field-by-field basis. A more general level of abstraction is the agricultural system, or the complex of crops and other land cover that differentiate various agricultural economies. The paper reports on a methodology to assist in the analysis of the landscape elements of agricultural systems with Landsat digital data. The methodology involves tracing periods of photosynthetic activity for a fixed area. Change from one agricultural system to another is detected through shifts in the intensity and periodicity of photosynthetic activity as recorded in the radiometric return to Landsat. The Landsat-derived radiometric indicator of photosynthetic activity appears to provide the ability to differentiate agricultural systems from each other as well as from conterminous natural vegetation. S.D.

**A79-48460** **Vegetation mapping in the gates of the Arctic National Park.** J. G. Lyon (Michigan, University, Ann Arbor, Mich.) and T. L. George (U.S. Forest Service, White Mountain Ranger Station, Bishop, Calif.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 483-497. 16 refs. NOAA-sponsored research. (ASP 79-183)

Through vegetation mapping at the 1:63,000-scale and field work, it was possible to evaluate Landsat data products for use in areas of limited resource information. The digital techniques used in the analysis include channel ratioing, edge enhancement, and principal component analysis. Major conclusions are that (1) band 5/7 convoluted (edge enhanced) imagery production is an accurate and rapid method for mapping Alpine tundra and taiga vegetation in the absence of resource information; (2) supervised classification of Landsat data is a useful technique but it potentially requires more ground truth and digital processing than interpretation of computer enhanced imagery; and (3) extensive field work and low-altitude oblique 35 mm photography allowed for satellite data accuracy analysis in the absence of recent aerial photography. S.D.

**A79-49819** **Mapping China's new agricultural lands.** R. Welch, H. C. Lo, and C. W. Pannell (Georgia, University, Athens, Ga.). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Sept. 1979, p. 1211, 1212, 1221-1228. 20 refs. Research supported by the University of Georgia; NSF Grant No. SOC-77-27701.

Landsat image data in photographic and computer compatible tape formats were used to map land use and identify crops in the Nun River Basin in China. Landsat scenes showed that 15,300 sq km of rangeland and wetland converted to agricultural uses are characterized by large geometric fields designed for mechanized farming. Soybean, corn/millet, and harvested wheat/millet crops were identified on two farms by computer assisted classification techniques in conjunction with crop calendars and spectral reflectance data. It was shown that food crops such as spring wheat and corn replaced soybeans, kaoliang, and millet as the principal crops in Northeast China. The absence of definitive ground truth in this study was overcome by the correlation of Landsat image data with maps and reports to provide a basis for an objective evaluation of China's land development policies. A.T.

**A79-49968** * **Satellite-sensed winter nocturnal temperature patterns of the Everglades Agricultural Area.** E. Chen, J. F. Bartholic, R. G. Bill, Jr., R. A. Sutherland (Florida, University, Gainesville, Fla.), and L. H. Allen, Jr. (Florida, University; U.S. Department of Agriculture, Gainesville, Fla.). *Journal of Applied Meteorology*, vol. 18, Aug. 1979, p. 992-1002. 11 refs. Contract No. NAS10-8920.

Surface temperature patterns of drained organic soil farmland in the Everglades Agricultural Area south of Lake Okeechobee, Florida, were studied using GOES-1 satellite infrared digital data for the winters of 1976-77 and 1977-78. Local thermal features were explained in terms of soil types, soil depths and climate modification

caused by organic soil drainage. A cold-prone area was delineated in the Everglades Agricultural Area with satellite data. The winter nighttime surface temperatures of this area were more characteristic of north central Florida, approximately 370 km further north, than of surrounding areas of mineral soil or undrained organic soil.
(Author)

**A79-50213** **Separation of various small grain LACIE spectral signatures using the evolution patterns of Householder transformation generating functions.** M. S. Bodner. *Remote Sensing Quarterly*, vol. 1, Jan. 1979, p. 6-37. 8 refs.

The paper presents an investigation made into the time evolution characteristics of several LACIE small grain spectral signatures. Data from one acquisition date is mapped onto the data from another acquisition date using a Householder transformation. The column vectors that generate the 4 x 4 transformation matrices are shown to exhibit patterns that may be characteristic for each crop type. Finally, the possibility of using such an analytical method for crop classification is discussed. M.E.P.

**A79-50331** **Low cost method of mapping land cover using satellite images.** C. D. Elifrits, T. W. Barney, C. J. Johannsen (Missouri-Columbia, University, Columbia, Mo.), and D. J. Barr (Missouri-Rolla, University, Rolla, Mo.). In: Learning to use our environment; Proceedings of the Twenty-fifth Annual Technical Meeting, Seattle, Wash., April 30-May 2, 1979.
Mount Prospect, Ill., Institute of Environmental Sciences, 1979, p. 21-36.

This paper describes some simple, inexpensive methodologies developed for general land cover (Level I) mapping using Landsat images. A step-by-step methodology, using interpretative techniques and direct tracing on an overlay of the image is described in detail. This methodology was developed through working with university students from different academic backgrounds and who had no previous experience in image interpretation. It has been successfully tested by use in workshops taught for regional planning-agencies and agronomy extension agents. The techniques used result in maps that are very accurate in relation to actual land cover and relative to the small investment in skill, time, and money needed to produce the product. (Author)

**A79-52501** **Determination of the moisture content of soils by microwave radiometry /Review/.** A. E. Bashrinov and A. M. Shutko. *(Radiotekhnika i Elektronika*, vol. 23, Sept. 1978, p. 1778-1791.) *Radio Engineering and Electronic Physics*, vol. 23, Sept. 1978, p. 1-12. 60 refs. Translation.

The paper is a survey of theoretical and experimental studies of the microwave radiometry of soil moisture. Consideration is given to the physics of moisture-radiation relationships, the radiation properties of nonuniformly moist soils, and the screening effect of vegetation. B.J.

**A79-53380** **Multitemporal remote sensing - Satellites provide a new tool for earth resources management.** G. Saint (Centre National d'Etudes Spatiales, Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-256*. 15 p.

This paper considers repeatability of earth observation from satellites and provides examples of the importance of this factor in several areas. Repeatability and fidelity in satellite remote sensing which allows the orbit to be computed so that the satellite returns to each location at fixed time intervals making comparisons and evolution studies feasible are discussed, noting that the raw data from the satellite must be preprocessed to correct their geometry and radiometry for the perturbing effects. The preprocessing of multitemporal data to correct variations between several images on the same site, and processing of multitemporal data to provide more precise sensing data are discussed. Applications of Landsat multitemporal data in agriculture for the evolution of a vegetation index for wheat, oats, and corn; in forestry to identify growth of different tree species; to determine snow cover extensions; and in studies of coastal zones evolution and the interaction between water and land are described. A.T.

**A79-53381** * **Advances in the development of remote sensing technology for agricultural applications.** J. E. Powers, R. B. Erb, F. G. Hall, and R. B. MacDonald (NASA, Johnson Space Center, Houston, Tex.). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-259*. 16 p. 18 refs.

The application of remote sensing technology to crop forecasting is discussed. The importance of crop forecasts to the world economy and agricultural management is explained, and the development of aerial and spaceborne remote sensing for global crop forecasting by the United States is outlined. The structure, goals and technical aspects of the Large Area Crop Inventory Experiment (LACIE) are presented, and main findings on the accuracy, efficiency, applicability and areas for further study of the LACIE procedure are reviewed. The current status of NASA crop forecasting activities in the United States and worldwide is discussed, and the objectives and organization of the newly created Agriculture and Resources Inventory Surveys through Aerospace Remote Sensing (AgRISTARS) program are presented. A.L.W.

**A79-53610** **A remote sensing application - Preprocessing and postprocessing aspects of forestry data analysis.** E. Kan (Lockheed Electronics, Co., Inc., Houston, Tex.). In: Digital signal processing. North Hollywood, Calif., Western Periodicals Co., 1979, p. 285-321. 46 refs.

Preprocessing and postprocessing aspects in the data analysis of a forestry remote sensing application are discussed. These aspects are representative of a major (but not the most general) earth resources application. Techniques used in these analyses range from classical digital filtering procedures to more heuristical scene analysis algorithms and represent recent research and development efforts. Application of these techniques on aircraft and satellite multispectral data is demonstrated. Finally, the outlook of future research and development on data processing of earth resources applications is presented. (Author)

**A79-53943** **Estimating irrigated land acreage from Landsat imagery.** R. C. Heller (Idaho, University, Moscow, Idaho) and K. A. Johnson (Idaho, Dept. of Water Resources, Boise, Idaho). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Oct. 1979, p. 1379-1386. 6 refs.

This article deals with the multistage variable probability sampling using multi-scale remote sensing data to inventory irrigated cropland within a large test site in Idaho. Landsat color transparencies were interpreted for the presence of irrigated agriculture by estimating the percentage of irrigated lands within two by two square mile blocks within the test site. Four interpreters made independent estimates of the irrigated land on all 270 blocks from which nine were selected with probability proportional to prediction. Sampling errors ranged from 6 to 10%, and four estimates were well within one standard deviation of the known acreage of irrigated land for the test site as measured from color infrared aerial phototransparencies. For developing countries with limited computer capabilities, this method requires minimal training and equipment for low cost estimates of irrigated lands. Landsat imagery was also used to determine location and magnitude of irrigated cropland expansion by constructing two date color composite images, so that newly irrigated cropland was indicated where fields had coloration distinct from those previously irrigated. A.T.

**A79-53944** **Landsat assisted forest land-cover assessment of the Philippine Islands.** H. M. Lachowski, D. L. Dietrich (GE Image Processing and Analysis Center, Beltsville, Md.), R. Umali, E. Aquino, and V. Basa (Department of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Oct. 1979, p. 1387-1391.

**N79-28633*#** Auburn Univ., Ala. Cooperative Extension Service.
**DETECTION OF PLANT STRESS THROUGH MULTISPECTRAL PHOTOGRAPHY Final Report**
T. B. Hagler and Sanford W. Downs, Jr., Principal Investigators (NASA. Marshall Space Flight Center) [1979] 13 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS8-29856)
(E79-10083; NASA-CR-161242; Circular-ANR-72) Avail: NTIS HC A02/MF A01 CSCL 14E

**N79-28635*#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
**UNIFORM COLOR SPACE ANALYSIS OF LACIE IMAGE PRODUCTS Progress Report, 15 Nov. 1977 - 14 Jun. 1978**
Richard F. Nalepka, Principal Investigator, R. J. Balon, and R. C. Cicone May 1979 144 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15476)
(E79-10221; NASA-CR-160236; ERIM-132400-10-R) Avail: NTIS HC A07/MF A01 CSCL 02C

The author has identified the following significant results. Analysis and comparison of image products generated by different algorithms show that the scaling and biasing of data channels for control of PFC primaries lead to loss of information (in a probability-of misclassification sense) by two major processes. In order of importance they are: neglecting the input of one channel of data in any one image, and failing to provide sufficient color resolution of the data. The scaling and biasing approach tends to distort distance relationships in data space and provides less than desirable resolution when the data variation is typical of a developed, nonhazy agricultural scene.

**N79-28638*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**RESEARCH IN REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES, AND MAN'S ENVIRONMENT Quarterly Report, 1 Mar. - 31 May 1979**
D. A. Landgrebe, Principal Investigator 31 May 1979 110 p refs EREP
(Contract NAS9-15466)
(E79-10224; NASA-CR-160241; LARS-CR-053179) Avail: NTIS HC A06/MF A01 CSCL 02C

**N79-28639*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). FURTHER EVALUATION OF PROCEDURE 1 SECONDARY ERROR ANALYSIS**
K. A. Havens, Principal Investigator May 1979 43 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10225; NASA-CR-160238; JSC-14746; LEC-13180) Avail: NTIS HC A03/MF A01 CSCL 05B

**N79-28640*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**NATIONWIDE FORESTRY APPLICATIONS PROGRAM. EVALUATION PROCESS FOR THE TEN-ECOSYSTEM STUDY**
R. H. Almond, Principal Investigator Apr. 1979 62 p refs Sponsored in part by US Forest Service EREP
(Contract NAS9-15800)
(E79-10226; NASA-CR-160243; LEC-12727; JSC-14872) Avail: NTIS HC A04/MF A01 CSCL 02C

**N79-28641*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EXAMPLES OF PHASE 3 OMISSION LABELING ERRORS**
N. James Clinton, Principal Investigator May 1979 15 p ref Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15800)
(E79-10227; NASA-CR-160237; JSC-14837; LEC-13198) Avail: NTIS HC A02/MF A01 CSCL 05B

**N79-28647*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ASSESSING SOYBEAN LEAF AREA AND LEAF BIOMASS BY SPECTRAL MEASUREMENTS**
Brent N. Holben, Compton J. Tucker, and Cheng-jing Fan Jul. 1979 22 p refs Submitted for publication
(NASA-TM-80312) Avail: NTIS HC A02/MF A01 CSCL 02C

Red and photographic infrared spectral radiances were correlated with soybean total leaf area index, green leaf area index, chlorotic leaf area index, green leaf biomass, chlorotic leaf biomass, and total biomass. The most significant correlations were found to exist between the IR/red radiance ratio data and green leaf area index and/or green leaf biomass (r squared equals 0.85 and 0.86, respectively). These findings demonstrate that remote sensing data can supply information basic to soybean canopy growth, development, and status by nondestructive determination of the green leaf area or green leaf biomass.
J.M.S.

**N79-30596*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**EFFECT OF THE ATMOSPHERE ON THE CLASSIFICATION OF LANDSAT DATA**
Nelson DeJesusParada, Principal Investigator, T. Morimoto, R. Kumar, and L. C. B. Molion Apr. 1979 11 p refs Presented at Symp. on Machine Processing of Remotely Sensed Data, Lafayette, Ind., 1979 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10235; NASA-CR-158799; INPE-1467-RPE/020) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. In conjunction with Turner's model for the correction of satellite data for atmospheric interference, the LOWTRAN-3 computer program was used to calculate the atmospheric interference. Use of the program improved the contrast between different natural targets in the MSS LANDSAT data of Brasilia, Brazil. The classification accuracy of sugar canes was improved by about 9% in the multispectral data of Ribeirao Preto, Sao Paulo. Author

**N79-30597*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**CLASSIFICATION OF AREAS USING PIXEL-BY-PIXEL AND SAMPLE CLASSIFIERS**
Nelson deJesusParada, Principal Investigator, R. Kumar, M. Niero, A. P. Manso, L. A. M. Lucht, and M. S. S. Barros Apr. 1979 16 p refs Presented at Intern. Conf. on Machine-Aided Image Analysis, Oxford, Engl., 4-6 Sep. 1978 . Sponsored by NASA ERTS

(E79-10236; NASA-CR-158800; INPE-1472-RPE/023) Avail: NTIS HC A02/MF A01 CSCL 05B

**N79-30600*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Jan. - 15 Apr. 1979**
Roger M. Hoffer, Principal Investigator Apr. 1979 8 p EREP
(Contract NAS9-15508)
(E79-10241; NASA-CR-160264; LARS-CR-041579) Avail: NTIS HC A02/MF A01 CSCL 08B

**N79-30601*#** Texas A&M Univ., College Station. Remote Sensing Center.
**LANDSAT RANGE RESOURCE INFORMATION SYSTEM PROJECT, VOLUME 1 Final Report, Dec. 1977 - Aug. 1979**
Harold Chilton, J. Clifford Harlan, Principal Investigators, and W. E. Boyd Jun. 1979 73 p EREP
(Contract NAS9-15468)
(E79-10242; NASA-CR-160270; RSC-3697-5) Avail: NTIS HC A04/MF A01 CSCL 02C

**N79-30602*#** Environmental Research Inst. of Michigan, Ann Arbor.
**THE ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 15 Nov. 1978 - 6 Mar. 1979**
Quentin A. Holmes, Principal Investigator, R. J. Kauth, R. C. Cicone, and W. A. Malila Mar. 1979 47 p refs EREP
(Contract NAS9-15476)
(E79-10243; NASA-CR-160259; ERIM-132400-20-P) Avail: NTIS HC A03/MF A01 CSCL 02C

**N79-30603*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**CORN YIELD MODEL FOR RIBEIRAO PRETO, SAO PAULO STATE, BRAZIL**
Nelson deJesusParada, Principal Investigator, Sherry Chou Chen, and Lourdes Bernadete daFonseca May 1979 15 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Submitted for publication ERTS
(E79-10244; NASA-CR-158807; INPE-1488-RPE/034) Avail: NTIS HC A02/MF A01 CSCL 02C

**N79-30604*#** Delaware Univ., Newark. Coll. of Marine Studies.
**APPLICABILITY OF SPACECRAFT REMOTE SENSING TO THE MANAGEMENT OF FOOD RESOURCES IN DEVELOPING COUNTRIES**
V. Klemas and D. J. Leu, Principal Investigators 31 Mar. 1977 55 p refs Sponsored by NASA and NSF ERTS
(E79-10245; NASA-CR-158808; CRS-1-79) Avail: NTIS HC A04/MF A01 CSCL 05A

**N79-30606*#** Kansas Univ. Center for Research, Inc., Lawrence.
**THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1978 - 31 Mar. 1979**
B. G. Barr, Principal Investigator and E. A. Martinko Jul. 1979 101 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-17-004-024)
(E79-10246; NASA-CR-158809) Avail: NTIS HC A06/MF A01 CSCL 13B

**N79-30608*#** Texas A&M Univ., College Station. Remote Sensing Center.
**CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Progress Report, Aug. 1978 - Feb. 1979**
Bruce J. Blanchard, Principal Investigator Feb. 1979 9 p ref ERTS
(Grant NsG-5193)
(E79-10247; NASA-CR-158810; RSC-3622-1) Avail: NTIS HC A02/MF A01 CSCL 08M

**N79-30610*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DECISION RULES FOR UNBIASED INVENTORY ESTIMATES**
P. Argentiero and David Koch Jul. 1979 27 p refs
(NASA-TM-80303) Avail: NTIS HC A03/MF A01 CSCL 05B

An efficient and accurate procedure for estimating inventories from remote sensing scenes is presented. In place of the conventional and expensive full dimensional Bayes decision rule, a one-dimensional feature extraction and classification technique was employed. It is shown that this efficient decision rule can be used to develop unbiased inventory estimates and that for large sample sizes typical of satellite derived remote sensing scenes, resulting accuracies are comparable or superior to more expensive alternative procedures. Mathematical details of the procedure are provided in the body of the report and in the appendix. Results of a numerical simulation of the technique using statistics obtained from an observed LANDSAT scene are included. The simulation demonstrates the effectiveness of the technique in computing accurate inventory estimates. Author

**N79-30612*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INTERPRETING VEGETATION REFLECTANCE MEASUREMENTS AS A FUNCTION OF SOLAR ZENITH ANGLE**
D. S. Kimes, J. A. Smith (Colorado State Univ., Ft. Collins), and K. J. Ranson (Colorado State Univ., Ft. Collins) Jul. 1979 35 p refs Submitted for publication
(NASA-TM-80320) Avail: NTIS HC A03/MF A01 CSCL 08F

Spectral hemispherical-conical reflectances of a nadir looking sensor were taken throughout the day for a lodgepole pine and two grass canopies. Mathematical simulations of both spectral hemispherical-conical and bi-hemispherical reflectances were performed for two theoretical canopies of contrasting geometric structure. These results and comparisons with literature studies showed a great amount of variability of vegetation canopy reflectances as a function of solar zenith angle. Explanations for this variability are discussed and recommendations for further measurements are proposed. K.L.

**N79-30614*#** National Aeronautics and Space Administration, Washington, D. C.
**LACIE (LARGE AREA CROP INVENTORY EXPERIMENT) PROGRAMME**
Ruth I. Whitman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 13-16 refs
Avail: NTIS HC A99/MF A01 CSCL 02C

Large Area Crop Inventory Experiment was a three year experiment conducted jointly by the United States Department of Agriculture, NASA, and NOAA (National Oceanic and Atmospheric Administration) to determine if global wheat production can be forecast from LANDSAT data to within 90% of actual yield for each observed 9 years out of 10. Data for the third crop year (1976-1977) was compiled. The proportional area of cultivated land devoted to wheat was estimated based on a statistical sampling of LANDSAT data. Yield is presently estimated by NOAA using regression models developed from historical weather and yield information. Results are discussed.
Author (ESA)

**N79-30616#** European Atomic Energy Community, Ispra (Italy).
**SUMMARY OF RESULTS OBTAINED DURING A EUROPEAN TELEDETECTION PROGRAM RELATED TO AGRICULTURE AND SILVICULTURE (AGRESTE PROJECT) [SYNTHESE DES RESULTATS ACQUIS DANS LE CADRE D'UN PROGRAMME DE COLLABORATION EUROPEENE EN TELEDETECTION, APPLIQUE A L'AGRICULTURE ET A LA SYLVICULTURE (PROJECT AGRESTE)]**
A. Berg, G. Flouzat (Centre d'Etude Spatiale des Rayonnements), and S. GallideParatesi *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 27-40 refs In FRENCH; ENGLISH summary

Avail: NTIS HC A99/MF A01

Different methods for the classification of multispectral data were perfected and used to verify the feasibility of teledetection techniques in Europe for agricultural and silvicultural resources management. Observations made from LANDSAT satellites and aircraft were used. Results are reported refering to the identification of the four vegetal species chosen. The relationship between rice reflectance and vegetation structure makes it possible to predict yield nearly two months before harvest. The early identification of rice virus diseases through the detection of spectral modifications in the vegetal cover is another important result. A model to estimate wood production from the Garonne valley is also discussed.
Author (ESA)

**N79-30622#** Operation Pilote Interministerielle de Teledetection, Paris (France).
**UTILIZATION OF LANDSAT FOR THE INVENTORY AND CARTOGRAPHY OF SOIL USES AND FOR TERRITORIAL ADMINISTRATION. MAIN EXPERIMENTS CARRIED OUT DURING THE FRENCH TELEDETECTION INTERMINISTERIAL PILOT OPERATION (OPIT) [UTILISATION DE LANDSAT POUR L'INVENTAIRE ET LA CARTOGRAPHIE DE L'UTILISATION DU SOL ET L'AMENAGEMENT DU TERRITOIRE: PRINCIPALES EXPERIMENTATIONS MENEES PAR L'OPIT]**
Marc Bied-Charreton *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 89-95 refs In FRENCH
Avail: NTIS HC A99/MF A01

Data from LANDSAT (soil use, humid areas, forest fires) pertinent to the Mediterranean region were numerically treated for an area of moderate altitude (Vosge's forests, Vivarais's forests), for an agriculture-sylviculture equilibrium zone (Limousin), and for a polyculture zone (Loire valley) in order to evaluate the usefulness of teledetection techniques vis a vis the needs of several government agencies (OPIT program). Several methodologic conclusions are listed, pointing out the insufficient development of various steps of the technical procedures. Conclusions relative to the contributions of teledetection are also listed. It is estimated that teledetection will satisfy most user's needs some years from now if the system elements are optimized.
Author (ESA)

**N79-30636#** Ford Aerospace and Communications Corp., Houston, Tex.
**AN APPLICATION PROCESSING SYSTEM FOR IMAGERY DATA**
John L. Benson, Richard Schell, J. Denton Tarbet, Lewis Bradford, Frank David, Gordon Dickinson, Jim Murphy, and Robert F. Purnell *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 229-232 refs Prepared in cooperation with US Dept. of Agr., Houston

Avail: NTIS HC A99/MF A01

The design approach and system installation for a processing system to support crop inventory using LANDSAT data is presented. The application test system (ATS) is currently being used by the United States Department of Agriculture (USDA) to support performance evaluation of remote sensing technology against USDA information requirements. The ATS described satisfies the USDA requirements in a cost effective manner and represents a major step in the transfer of remote sensing technology to a user organization.
Author (ESA)

**N79-30643#** Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
**UTILIZATION OF CLASSIFICATION ALGORITHMS FOR SPECTRAL AND TEXTURAL DATA IN THE STUDY OF AN AGRICULTURAL ZONE [UTILISATION D'ALGORITHMES DE CLASSIFICATION DES INFORMATIONS PECTRALES ET TEXTURALES POUR L'ETUDE D'UNE ZONE AGRICOLE]**
T. LeToan, P. Cassirame, J. Quach, and M. Monchant *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 269-276 refs In FRENCH

Avail: NTIS HC A99/MF A01

Classification algorithms were used on multispectral band scanning images from LANDSAT satellites and aerial photography in order to identify crops. The satellite information was introduced after a preliminary study about the fields homogeneity, and the classification done using the texture notion was compared with the results from aerial images. Several classification algorithms were studied and multitemporal date were also considered. Results show that crop inventories are possible using multispectral classification of LANDSAT images. Introduction of multitemporal data improves the results. The best adapted classification method found is the pondered euclidian distance supervised method.
Author (ESA)

**N79-30645#** Technische Hogeschool, Delft (Netherlands).
**THE INTERACTION OF VEGETATED AND BARE FIELDS WITH 3cm WAVELENGTH ELECTROMAGNETIC RADIATION. MODELING AND EXPERIMENT**
E. P. W. Attema *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 299-304 refs
Avail: NTIS HC A99/MF A01

An experimental program of ground based short range scatterometry on bare and vegetated test fields planted with different types of crops and natural vegetations was carried out. The acquired data base consists of radar data at X-band frequencies using HH, VV, and HV polarization, accompanied by plant parameter measurements and measurements of soil moisture. These data are used for the evaluation of the potential of available space sensors for agricultural missions. Accomplishing these objectives effectively requires an understanding of the wave interaction with the object. This insight was obtained on the by carefully designed experiments and by modeling the wave interaction using the experimental data. A progress report is presented on the models that were checked against the measurements and the models that were constructed using the experimental results.
Author (ESA)

**N79-30677#** Centre National d'Etudes Spatiales, Paris (France).
**UTILIZATION OF REMOTE SENSING DATA FOR CROP FORECASTING MODELS: ECONOMIC ADVANTAGES [UTILISATION DES DONNEES RECUEILLIES PAR TELEDETECTION POUR LES MODELES DE PREVISION DE RECOLTES: AVANTAGES ECONOMIQUES]**
G. Fraysse, P. Mallet, and B. Susplugas *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 549-561 refs In FRENCH

Avail: NTIS HC A99/MF A01

Improvement of crop forecasting models by means of remote sensing data utilization was analyzed. The models studied include climatic regression models, agrometeorological models, and the bio-climatic and bio-structural models. The contributions of remote sensing data are discussed for each of these models. A specific example referring to a corn crop is presented. It is concluded that these models can be effectively improved by remote sensing data and that definite cost advantages are attainable.
Author (ESA)

**N79-31710*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET DATA BASE FOR SPRING AND WINTER WHEAT, VOLUME 1**
M. H. Trenchard, Principal Investigator, M. L. Sestak, M. C. Kinsler, and D. E. Phinney May 1979 26 p Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10250; NASA-CR-160283; JSC-14901-Vol-1; LEC-13393-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 02C

**N79-31711*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). RESEARCH PLAN FOR DEVELOPING AND EVALUATING CLASSIFIERS**
C. B. Chittineni, Principal Investigator Jul. 1979 20 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10251; NASA-CR-160285; LACIE-00633; JSC-14849; LEC-13300) Avail: NTIS HC A02/MF A01 CSCL 02C

**N79-31719*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**FOREST RESOURCE INFORMATION SYSTEM. PHASE 2: DEMONSTRATION REPORT Quarterly Report, 1 Jan. - 30 Apr. 1979**
R. P. Mroczyski, Principal Investigator 30 Apr. 1979 139 p refs EREP
(Contract NAS9-15325)
(E79-10259; NASA-CR-160275; LARS-043079) Avail: NTIS HC A07/MF A01 CSCL 02F

**N79-31721*#** ECON, Inc., Princeton, N. J.
**THE ECONOMIC COSTS AND BENEFITS OF AN INTERNATIONAL GRAIN RESERVE PROGRAM WITH AND WITHOUT IMPROVED (LANDSAT) CROP INFORMATION: A CASE STUDY BASED ON THE ECON INTEGRATED MODEL Final Report**
31 Dec. 1978 63 p refs ERTS
(Contract NASw-3047)
(E79-10261; NASA-CR-158876; ECON-77-294-1) Avail: NTIS HC A04/MF A01 CSCL 17B

**N79-31722*#** ECON, Inc., Princeton, N. J.
**THE ECONOMIC COSTS AND BENEFITS OF AN INTERNATIONAL GRAIN RESERVE PROGRAM WITH AND WITHOUT IMPROVED (LANDSAT) CROP INFORMATION: A CASE STUDY BASED ON THE ECON INTEGRATED MODEL, SUMMARY AND OVERVIEW Final Report**
31 Dec. 1978 25 p refs ERTS
(Contract NASw-3047)
(E79-10262; NASA-CR-158877; ECON-77-294-2) Avail: NTIS HC A02/MF A01 CSCL 17B

**N79-31726*#** Dartmouth Coll., Hanover, N.H.
**AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Jan. - 30 Jun. 1979**
Richard W. Birnie and Richard E. Stoiber, Principal Investigators 30 Jun. 1979 28 p refs ERTS
(Grant NsG-5014)
(E79-10267; NASA-CR-157428; SASR-10) Avail: NTIS HC A03/MF A01

**N79-31735*#** Texas A&M Univ., College Station. Remote Sensing Center.
**DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Quarterly Progress Report, Apr. - Jul. 1979**
Wesley D. Rosenthal and James C. Harlan, Principal Investigators 30 Jul. 1979 1 p ERTS
(Contract NAS5-24383)
(E79-10278; NASA-CR-162100) Avail: NTIS HC A02/MF A01 CSCL 02C

**N79-32605*#** Lockheed Electronics Co., Houston, Tex.
**THE ECOLOGICAL VARIATIONS IN THERMAL INFRARED EMISSIVITY OF VEGETATION**
G. K. Arp and D. E. Phinney, Principal Investigator Apr. 1979 27 p refs Supersedes LEC-11021-Rev-B EREP
(Contract NAS9-15200)
(E79-10271; NASA-CR-160293; LEC-13390; JSC-14910; LEC-11021-Rev-B) Avail: NTIS HC A03/MF A01 CSCL 08F

The author has identified the following significant results. Through a series of contrasts, the statistical significance of differences in emissivity was determined for vegegation in dry and humid deserts, montane and deciduous rain forests, and the temperate region. No significant differences were found between the two types of desert vegetation or among the types of nondesert vegetation. However, the rain forest vegetation was significantly different from that of the temperate region. On a community-wide level, there is some physiological adaptation in plants to their radiational environment.

**N79-32606*#** Department of Agriculture, Weslaco, Tex. Science and Education Administration.
**PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Jun. - 1 Sep. 1979**
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Sep. 1979 5 p Sponsored by NASA ERTS
(NASA Order S-40198-B)
(E79-10280; NASA-CR-162145) Avail: NTIS HC A02/MF A01 CSCL 08F

**N79-32608*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). SAMPLING UNIT SIZE CONSIDERATIONS IN LARGE AREA CROP INVENTORYING USING SATELLITE-BASED DATA**
Charles R. Perry, Principal Investigator 1979 17 p refs Presented at Ann. Meeting of the Am. Statistical Assoc., Washington, D. C., 13-16 Aug. 1979 Sponsored by NASA,

NOAA, and USDA EREP
(E79-10283; NASA-TM-80511) Avail: NTIS HC A02/MF A01 CSCL 02C

**N79-32610*#** Telespazio, S.p.A., Rome (Italy).

**FEATURE SELECTION VIA ENTROPY MINIMIZATION: AN EXAMPLE USING LANDSAT SATELLITE DATA**

Angelo Zandonella and Buzz Sellman, Principal Investigators 1979 12 p refs Presented at the 2d Convegno sulle Metodologic di Trattamento dell'Informazione, Trieste, Feb. 1979 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10286; NASA-CR-162273) Avail: NTIS HC A02/MF A01 CSCL 08F

The author has identified the following significant results. The minimum entropy model may provide several useful advantages over traditional techniques for processing LANDSAT data. Total computer time to conduct a complete pattern recognition process is reduced. Subjective (transformed image), as well as statistically derived information is made available to the analyst/user much earlier in the analysis process. A rapid feedback loop in which numerous training set combinations can be tested for difference and representativeness is available. Additional tests of LANDSAT data processing using the minimum entropy model are clearly justified.

**N79-33520*#** Environmental Research Inst. of Michigan, Ann Arbor.

**ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Mar. - 6 Jun. 1979**

Richard C. Cicone, Principal Investigator, E. Crist, Quentin A. Holmes, Richard J. Kauth, P. Lambeck, William A. Malila, W. Pont, and W. Richardson Aug. 1979 155 p EREP
(Contract NAS9-15476)
(E79-10284; NASA-CR-160304; ERIM-132400-24-P) Avail: NTIS HC A08/MF A01 CSCL 02C

**N79-33530*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**EFFECTS OF VEGETATION CANOPY STRUCTURE ON REMOTELY SENSED CANOPY TEMPERATURES**

Daniel S. Kimes Jul. 1979 20 p refs
(NASA-TM-80331) Avail: NTIS HC A02/MF A01 CSCL 08F

The effects of vegetation canopy structure on thermal infrared sensor response must be understood before vegetation surface temperatures of canopies with low percent ground cover can be accurately inferred. The response of a sensor is a function of vegetation geometric structure, the vertical surface temperature distribution of the canopy components, and sensor view angle. Large deviations between the nadir sensor effective radiant temperature (ERT) and vegetation ERT for a soybean canopy were observed throughout the growing season. The nadir sensor ERT of a soybean canopy with 35 percent ground cover deviated from the vegetation ERT by as much as 11 C during the mid-day. These deviations were quantitatively explained as a function of canopy structure and soil temperature. Remote sensing techniques which determine the vegetation canopy temperature(s) from the sensor response need to be studied. A.R.H.

**N79-33533#** Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.

**TERRAIN FEATURE CANOPY MODELING Final Report**

D. S. Kimes, James A. Smith, and K. J. Ranson 30 Apr. 1979 194 p
(Contract DACW39-77-C-0073; Grants DAAG29-78-G-0045; DAAG29-76-G-0105)
(AD-A071793; ARO-13444.2) Avail: NTIS HC A09/MF A01 CSCL 02/6

A thermal canopy signature model (TCSM) was developed to approximate the thermal behavior of a vegetation canopy by a mathematical abstraction of three horizontal layers of vegetation. Canopy geometry within each layer is quantitatively described by the foliage and branch orientation distributions. Canopy geometry, solar irradiance, air temperature, horizontal wind velocity, relative humidity, and ground temperature are used to calculate the energy budgets of average leaves within each layer. The resulting system of conservation equations is solved for the average layer temperature. This information, together with the angular distributions of radiating elements, is then used to calculate the thermal existance as a function of view angle above the canopy. Optical diffraction techniques were developed and employed to measure canopy geometry. Solar radiation absorption with the vegetation terrain elements is calculated using a modification of a Monte Carlo model (SRVC) developed for the reflective energy regime. The models were applied to a lodgepole pine (Pinus contorta) canopy and the results for a diurnal cycle are validated with radiometric measurements. Simulated versus measured radiometric average temperatures of Layer 2 correspond approximately within two degrees centigrade. Simulated results suggest that canopy geometry can significantly influence the effective radiant temperature recorded by a sensor above the canopy as a function of view angle. GRA

# 02
# ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

**Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.**

**A79-48472 *** **Assessing urbanized area expansion through the integration of Landsat and conventional data /79052/.** J. B. Davis (U.S. Bureau of the Census, Geography Div., Washington, D.C.) and S. Z. Friedman (California Institute of Technology, Jet Propulsion Laboratory, Earth Resources Applications Group, Pasadena, Calif.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 776-791. 13 refs. Contract No. NAS7-100. (ASP 79-230)

An image base information system (IBIS) is utilized to integrate Landsat and census data for the purpose of mapping urban land and updating urbanized-area outer lines. IBIS is a subset of the video image communication and retrieval digital image processing system developed at JPL. IBIS is used to analyze three urban areas: Orlando, Florida; Seattle, Washington; and Boston, Massachusetts. In all three applications the primary objective is to map the expansion of urban land cover in the urban fringe. Pertinent tabular reports are produced. S.D.

**A79-50216 *** **The detection of urban expansion from Landsat imagery.** S. Z. Friedman and G. L. Angelici (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 58-79. 6 refs.

Two methodologies for detecting and mapping land cover changes in and around growing urban regions are being studied at Jet Propulsion Laboratory. Both approaches, primarily based on digital image processing techniques, have been developed to supplement data stored in an Image Based Information System (IBIS). The structure of this information system enables the depiction of land cover changes in image format concurrently with statistical reports in tabular form. To date the expansion of two urban areas, Houston, Texas and Orlando, Florida, has been monitored. (Author)

**A79-50217 *** **Using population statistics for a first look at the utility of Landsat data for urban areas.** A. J. Landini (Los Angeles City Planning Dept., Los Angeles, Calif.) and R. G. McLeod (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 80-105. 5 refs.

The paper reviews the Image Based Information System (IBIS), developed at the Jet Propulsion Laboratory (JPL) which provided the city of Los Angeles with Landsat land use data in a format compatible with the city's land use and population files. Landsat data are compared to other land use files and the comparisons are discussed as an attempt to establish a level of validity. Relationships between population and Landsat data are investigated and reveal the strengths and weaknesses of the use of such data for urban areas. Finally, it is noted that the project verified the flexibility of IBIS for reducing and delivering Landsat data to users lacking the ability to process raw satellite data tapes and points to the system as a model for a potential national census of land use. M.E.P.

**A79-50218** **Distributed parameter modelling of urban residential energy demand.** C. Clayton and J. E. Estes (California, University, Santa Barbara, Calif.). *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 106-115. 10 refs.

The paper presents a conceptual model illustrating the potential use of remotely sensed imagery for improving the prediction of residential energy demand in urban areas. The model is composed of four segments: (1) the evaluation, selection, and application of existing econometric models built to predict energy demand; (2) the use of data from remote sensor systems and collateral sources to provide spatially distributed estimates of the magnitude of and change in the independent variables contained in the econometric models; (3) the use of imagery from successive time periods to construct a predictive land use change model; and (4) the development of a predictive energy demand model based on changing land use patterns. Such a model, when fully operational, could effectively attain two important goals: (1) provide the ability to forecast gross future energy consumption; and (2) have the capability to predict the spatial location of such future demand. The research reported describes a conceptual model designed to predict the magnitude and location of residential energy demand in an urban environment and also predict its future location. (Author)

**A79-50219 *** **Solar potential inventory and modeling.** G. L. Angelici and N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly,* vol. 1, Apr. 1979, p. 5-16.

Image processing procedures for calculating the energy that roof-mounted solar collectors can potentially supply in a metropolitan area are presented. Satellite multispectral imagery from which land cover types can be determined digitally was sampled in order to estimate the percentage of land area occupied by flat or south-facing roof tops in residential and commercial/industrial areas. Procedures were applied to the various power subdistricts of the western San Fernando valley of California, and it was found that on the average 120% of the existing power demand could be met if only half the useable rooftop area were utilized, amounting to 385 MW of peak power and indicating the applicability of solar cells to power generation in urban areas. A.L.W.

**A79-50222** **An overview of land use data availability and accuracy.** Y. H. Fan. *Remote Sensing Quarterly,* vol. 1, July 1979, p. 7-13. 17 refs.

There are two ways to obtain land use data: (1) by gathering and using existing general-purpose data with caution; and (2) by producing new custom-made data of one's own design. Both ways have their limitations. The paper identifies some of these limitations that contribute to users' land use data problems, especially those associated with remote sensing. The relatively recent remote sensing technology is considered to be a method to acquire new land use data, while the traditional land use survey is assumed to be the source for existing land use data. The discussion presents a general picture of land use data availability and accuracy, with particular reference to remote sensing. The data exhibit varied reliability, depending on definition, source, the way of acquisition and application. Land-use data users are recommended not to demand accuracy in excess of their actual requirements. S.D.

**A79-53430** **Some consideration of satellite technology applications for disaster matters - Looking to the future.** H. G. S. Murthy and D. Felske (United Nations, Outer Space Affairs Div., New York, N.Y.). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-A-32.* 7 p. 6 refs.

The paper demonstrates that satellite telecommunication and remote sensing technology can be of tremendous help by providing information for early warning of potential disasters or on the area affected and the damage caused by disasters. The role satellite technology can play in predicting, detecting, early warning and relief operations as diverse as the phenomena of disaster occurrence itself. A more distinct assessment of satellite technology applications in coping with disaster situations can be made by distinguishing between sudden and creeping disasters. In future, maximum effort must be devoted to the development of methods for prediction, early detection and early warning of sudden disasters such as earthquakes and volcano eruptions. S.D.

**N79-28650#** Army Construction Engineering Research Lab., Champaign, Ill.

**GRAPHIC MATERIALS TO SUPPORT BIOPHYSICAL QUANTITATIVE ENVIRONMENTAL IMPACT ANALYSIS: SOURCES OF EXISTING MATERIALS Final Report**

W. D. Goran and R. E. Riggins Mar. 1979 83 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A069097; CERL-TR-N-68) Avail: NTIS HC A05/MF A01 CSCL 08/2

This report identifies and describes resource materials (maps and imagery) currently available for environmental impact analysis on U.S. Army military installations. Only materials that relate to the biophysical and land use elements of the environment are considered. The report describes procedures for obtaining these materials and lists specific materials relevant to major U.S. Army military installations. This report also provides some tables, formulas, and procedures for quantitatively analyzing these graphical representations of environmental information. Author (GRA)

**N79-29569#** Forest Service, Vernal, Utah.

**HIGH UINTAS SOUTH SLOPE LAND MANAGEMENT PLAN AND FINAL ENVIRONMENTAL STATEMENT**

Mar. 1979 532 p refs Original contains color illustrations
Avail: NTIS HC A23/MF A01

Management alternatives for the High Uintas South Slope and Roadless Area were considered. The principal issues were the coordination of management with the Central Utah Project and the designation of roadless areas to be managed for their wilderness values. The selected alternative calls for developments of recreation facilities around the Central Utah Project reservoirs in the canyon bottoms, and commodity production from the intervening plateaus. J.M.S.

**N79-29572#** Army Engineer Topographic Labs., Fort Belvoir, Va.

**TERRAIN ANALYSIS PROCEDURAL GUIDE FOR VEGETATION**

Jeffrey A. Messmore, Theodore C. Vogel, and Alexander R. Pearson Mar. 1979 215 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A068715; ETL-0178) Avail: NTIS HC A10/MF A01 CSCL 08/6

This procedural guide provides the U.S. Army Terrain Analyst with the necessary step-by-step procedures to be used in generation of vegetation factor overlays and supportive data tables. Three potential sources of information on vegetation are considered: (1) military topographic maps, (2) literature, and (3) aerial imagery. Procedures are presented for each of 13 data elements that characterize vegetation of the geographic area of interest. The included appendixes provide the Terrain Analyst with additional reference information. GRA

**N79-29722*#** System Planning Corp., Arlington, Va.

**POLAR ENVIRONMENTAL MONITORING Final Report**

Robert G. Nagler and Andreas C. Schultels Feb. 1979 95 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955068)
(NASA-CR-158866; SPC-392) Avail: NTIS HC A05/MF A01 CSCL 08F

The present and projected benefits of the polar regions were reviewed and then translated into information needs in order to support the array of polar activities anticipated. These needs included measurement sensitivities for polar environmental data (ice/snow, atmosphere, and ocean data for integrated support) and the processing and delivery requirements which determine the effectiveness of environmental services. An assessment was made of how well electromagnetic signals can be converted into polar environmental information. The array of sensor developments in process or proposed were also evaluated as to the spectral diversity, aperture sizes, and swathing capabilities available to provide these measurements from spacecraft, aircraft, or in situ platforms. Global coverage and local coverage densification options were studied in terms of alternative spacecraft trajectories and aircraft flight paths. R.E.S.

**N79-30629#** Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier (France).

**COMPATIBILITY BETWEEN MANIFESTED AND POTENTIAL NEEDS AND THE POSSIBILITIES OFFERED BY SPACEBORNE TELEDETECTION FOR MEDITERRANEAN DEVELOPING COUNTRIES [COMPATIBILITE ENTRE BESOINS EXPRIMES ET POTENTIELS ET POSSIBILITES OFFERTES PAR LA TELEDETECTION SPATIALE DANS LE CAS DES ZONES ARIDES DES PAYS EN VOIE DE DEVELOPPMENT DE LA REGION MEDITERRANEENNE]**

Gilbert Long *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 155-160 refs In FRENCH
Avail: NTIS HC A99/MF A01

The conditions necessary to the compatibility of the possibilities offered by spaceborne teledetection with the inventory, evaluation, prevision, and monitoring needs of the zones being considered are examined. The discussion is based on results obtained from the ARZOTU program (LANDSAT, south of Tunisia). The technological, thematic, institutional, and financial problems are pointed out. Author (ESA)

**N79-31707*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**UTILIZATION OF THE LANDSAT IMAGES ON THE STUDY OF THE IMPACT OF VICINITY HIGHWAYS [APLICACAO DAS IMAGENS DO LANDSAT AO ESTUDO DE IMPACTOS DE RODOVIAS VICINAIS]**

Nelson deJesusParada, Principal Investigator, Madalena Niero, and Luiz Fernando R. H. Rodrigues Mar. 1979 25 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E79-10239; NASA-CR-158803; INPE-1441-NTE/147) Avail: NTIS HC A02/MF A01 CSCL 08B

**N79-31736*#** National Aeronautics and Space Administration, Washington, D. C.

**REMOTE SENSING**

Armando Jinich Aug. 1979 25 p refs Transl. into ENGLISH from Ciencia y Desarrollo (Mexico), no. 26, May/Jun. 1979 p 33-41, 45 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75651) Avail: NTIS HC A02/MF A01 CSCL 05B

Various imaging techniques are outlined for use in mapping, land use, and land management in Mexico. Among the techniques discussed are pattern recognition and photographic processing. The utilization of information from remote sensing devices on satellites are studied. Multispectral band scanners are examined and software, hardware, and other program requirements are surveyed. A.W.H.

**N79-31839*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**REMOTE MONITORING OF THE GRAVELLY RUN THERMAL PLUME AT HOPEWELL AND THE THERMAL PLUME AT THE SURRY NUCLEAR POWER PLANT ON THE JAMES RIVER**

T. A. Talay, K. W. Sykes (Army Corps of Engineers, Norfolk, Va.), and C. Y. Kuo (Virginia Polytechnic Inst. and State Univ., Blacksburg) Jul. 1979 21 p refs Presented at the Virginia Academy of Science, 56th Ann. Meeting, Blacksburg, 9-12 May 1978
(NASA-TM-80124) Avail: NTIS HC A02/MF A01 CSCL 13B

On May 17, 1977, a remote sensing experiment was conducted on the James River, Virginia, whereby thermal spectrometer and near-infrared photography data of thermal discharges at Hopewell and the Surry nuclear power plant were obtained by an aircraft for one tidal cycle. These data were used in subsequent investigations into the near field discharge trajectories. For the Gravelly Run thermal plume at Hopewell, several empirical expressions for the plume centerline were evaluated by comparisons of the computed trajectories and those observed in the remote sensing images. Author

**N79-32604*#** Pennsylvania State Univ., University Park. Dept. of Meteorology.
**DETERMINATION OF SURFACE CHARACTERISTICS AND ENERGY BUDGET OVER AN URBAN-RURAL AREA USING SATELLITE DATA AND A BOUNDARY LAYER MODEL M.S. Thesis**
Joseph Kent Dodd, Principal Investigator Aug. 1979 96 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-24264)
(E79-10269; NASA-CR-162091) Avail: NTIS HC A05/MF A01 CSCL 04B

**N79-32613#** Geological Survey, Washington, D. C.
**GEORGIA FROM SPACE: AN EXPLANATION OF THE NASA LANDSAT 1 SATELLITE IMAGE COLOR MOSAIC OF THE STATE OF GEORGIA**
Sam M. Pickering, Jr. and Michael W. Higgins 1979 25 p refs Prepared in cooperation with Georgia Dept. of Natural Resources, Atlanta
(Circ-787) Avail: NTIS HC A02/MF A01 CSCL 08F

Fourteen scenes were precisely joined by computer to make the mosaic of Georgia. On the mosaic, high-contrast features as small as 25 acres can be seen. The mosaic shows the cultural features of the State such as cities, roads, and other developments. It shows land use and land cover-woodlands, wetlands, cultivated areas, reservoirs, and so forth. Landforms and geologic features are also easily seen. A.R.H.

**N79-32624#** Geological Survey, Reston, Va.
**US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: EVERGLADES NATIONAL PARK**
Janet M. Bonner 1979 105 p
(PB-296353/6) Avail: NTIS HC A06/MF A01 CSCL 13B

Remotely sensed data gathered from spacecraft and aircraft are presented for the Everglades National Park biosphere reserve. Computer listings of the data are given. GRA

**N79-33516*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**CATALOG OF EARTH PHOTOGRAPHS FROM THE APOLLO-SOYUZ TEST PROJECT**
Farouk El-Baz, ed. (Smithsonian Inst., Washington, D. C.) Sep. 1979 295 p ref
(NASA-TM-58218; JSC-14904) Avail: NTIS HC A13 CSCL 05B

Information is given on earth photographs obtained by the Apollo astronauts during the Apollo Soyuz Test Project. The data are arranged in three sections. A map index shows the boundaries of each photograph and is used for a quick survey of the coverage for a given geographical area. A tabular index provides the following data: list of photographs by serial number, description of geographic location, latitude and longitude of the center point of the photograph, date when photograph was taken, ground elapsed time, revolution number of Apollo spacecraft, approximate spacecraft altitude, tilt, sun angle, camera, and lens. The photographic index provides same size black and white prints made from the original color negatives. A.W.H.

**N79-33521*#** Montana Univ., Missoula.
**GRIZZLY BEAR HABITAT ANALYSIS, SECTION 1**
John J. Craighead, Gordon B. Scaggs, and Jay S. Sumner, Principal Investigators 1979 190 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10288; NASA-CR-162275) Avail: NTIS HC A09/MF A01 CSCL 06C

**N79-33522*#** Arizona Univ., Tucson. Office of Arid Lands Studies.
**APPLIED REMOTE SENSING PROGRAM (ARSP) Annual Report, 1978 - 1979**
Jack D. Johnson, Kennith E. Foster, David A. Mouat, Principal investigators, Robert Schowengerdt, Kim Mortensen, Charles Sauerwein, Dean Treadwell, and Arye Topor Aug. 1979 89 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57188 ERTS
(Grant NGL-03-002-313)
(E79-10289; NASA-CR-162281) Avail: NTIS HC A05/MF A01 CSCL 05B

**N79-33523*#** California Univ., Berkeley. Space Sciences Lab.
**APPLICATION OF REMOTE SENSING TO SELECTED PROBLEMS WITHIN THE STATE OF CALIFORNIA Annual Progress Report**
Robert N. Colwell, Andrew S. Benson, John E. Estes, and Leonard W. Bowden, Principal Investigators 1 May 1979 339 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-7220)
(E79-10290; NASA-CR-162282; SSL-Ser-20-Issue-25) Avail: NTIS HC A15/MF A01 CSCL 08F

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## 03

## GEODESY AND CARTOGRAPHY

**Includes mapping and topography.**

**A79-44132** # **Gridding of satellite scanner imagery using trajectory data (Prostranstvennaia priviazka sputnikovykh skanernykh izobrazhenii po traektornym dannym).** A. P. Tishchenko and V. P. Golovchin. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 56-65. In Russian.

Equations relating the geographical coordinates of a given point on the earth's surface with orbital elements, satellite orientation parameters and the scanning law are derived. The solution of these equations is presented, and a method for applying them to the gridding of imagery from satellite scanners is suggested. C.K.D.

**A79-44138** # **A method of defining the components of a mixture of piecewise-homogeneous sections of the earth's surface (Metod opredeleniia komponent smesi kusochno-odnorodnykh uchastkov zemnoi poverkhnosti).** V. V. Egorov and M. V. Khatuntseva. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 126-131. In Russian.

A method is described for partitioning the components of a mixture of piecewise-homogeneous sections of the earth's surface on the basis of an analysis of a unidimensional histogram of the intensity of the electromagnetic radiation received. The computer method is based on application of a fast Fourier transform, and can be extended for use with two-dimensional histograms. C.K.D.

**A79-44146** # **Investigation of the brightness field of earth landscapes (Ob izuchenii iarkostnogo polia zemnykh landshaftov).** V. A. Kottsov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 185-192. In Russian.

**A79-50215** **The utilization of side-looking airborne radar /SLAR/ in the analysis of karst topography.** C. L. Smith and A. P. Tribble (U.S. Air Force Academy, Colorado Springs, Colo.). *Remote Sensing Quarterly*, vol. 1, Jan. 1979, p. 49-57. 10 refs.

The need for research into the use of remotely sensed imagery to identify geomorphic features within various landscapes is noted. The present paper discusses the possibility of using side-looking airborne radar (SLAR) to identify karst topography. The major features of karst topography are described including sinkholes, hums and haystack hills. In addition, the basic applications of the sensor system are discussed. Finally, examples of SLAR imaged karst topography are presented. M.E.P.

**A79-53583** # **Geodetic theory.** D. H. Eckhardt (USAF, Geophysics Laboratory, Bedford, Mass.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics*, vol. 17, Sept. 1979, p. 1353-1358. 110 refs.

A summary of geodetic theory advances during 1974 through 1978 is presented. Geodetic network computations and theory of errors involving redefinition of North American geodetic networks and a collocation technique, physical geodesy statistics and geophysical correlations including investigation of covariance functions of physical geodesy and modeling of the earth's mantle, gravity field modeling from measurements of terrestrial gravity and satellite dynamics and algorithms for computing the potential and attraction of a simple density layer, and satellite altimetry adjustments using the Skylab altimeter data are discussed. A.T.

**A79-53584** # **Geodetic instrumentation.** B. L. Decker (U.S. Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Mo.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics*, vol. 17, Sept. 1979, p. 1358-1370. 270 refs.

Developments in geodetic instrumentation during 1975 through 1978 are reviewed. Distance measurement including electronic distance measuring (EDM) application and instrumentation; the improvement of astronomic latitude and longitude determinations by the development of Automated Astronomic Positioning System and an instrument capable of measuring atmospheric refraction and evaluation of the magnitude of anomalous refraction at an observing site; new techniques for astronomic azimuth determination, transfer, and monitoring, such as ring laser gyroscopes, nuclear magnetic resonance gyroscopes with optical readout, and fiber optics gyroscopes; absolute gravity measurements, relative gravity measurements with electronic readout system and a portable battery powered microprocessor used with gravimeters and gravity gradiometry are discussed. The Inertial Positioning System, an Aerial Profiling of Terrain System, the Very Long Baseline Interferometry, Satellite Laser ranging, Doppler satellite instrumentation, and radar altimeters are described. A.T.

**A79-53585** # **Control surveys.** J. F. Dracup (NOAA, Control Networks Div., Rockville, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics*, vol. 17, Sept. 1979, p. 1371-1380. 95 refs.

The progress of geodetic control surveys during 1975 through 1978 is reviewed. During this period improved instrumentation, observing procedures, and data reduction methods increased accuracies of Doppler satellite determined positions, inertial positioning systems were in greater use, and the multiwavelength distance measuring instruments became available. Horizontal control surveys by the National Ocean Survey, Bureau of Land Management, Defense Mapping Agency Hydrographic/Topographic Center-Geodetic Survey Squadron, TVA, U.S. Army Corps of Engineers, U.S. Geological Survey, and the U.S. Naval Oceanographic Office are discussed. The vertical control program to meet the needs of engineering projects, topographic mapping, and scientific studies related to crustal motion in seismic areas performed by these agencies was described, and, finally, geodetic astronomy developments are examined. A.T.

**A79-53590** * # **Dynamic satellite geodesy.** D. E. Smith (NASA, Goddard Space Flight Center, Geodynamics Branch, Greenbelt, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics*, vol. 17, Sept. 1979, p. 1411-1418. 120 refs.

The paper describes operation of the GEOS-3 and Lageos spacecraft launched by NASA as part of the Earth and Ocean Dynamic Program. The investigations conducted by using GEOS-3 include the determination of tracking station coordinates, polar motion, and the use of altimetry in orbit determination. Lageos was designed as a precision target for making geodetic measurements with ground laser systems. Consideration is given to the progress made in the investigation and determination of tidal parameters by means of satellite perturbation methods. Satellite geodetic methods based on the ability to determine precise satellite orbits and orbit determination are outlined. Emphasis is placed on the future studies employing Spaceborne Laser and Global Positioning System concepts. V.T.

**N79-30624#** Universite des Sciences et Techniques de Lille (France).

**THE CONTRIBUTION OF TELEDETECTION TO THE CARTOGRAPHY OF THE FRENCH AGRARIAN COUNTRYSIDE [APPORTS DE LA TELEDECTION A LA CARTOGRAPHIE DES PAYSAGES AGRAIRES FRANCAIS]**

J. Coudoux *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 103-116 refs In FRENCH

Avail: NTIS HC A99/MF A01

The French agrarian countryside was studied based on LANDSAT 1 and 2 image data. The research methods reviewed are visual approach and cartographic survey. The analysis of the agrarian elements and their components made possible the identification of criteria useful in the preliminary selection of raw data, but difficulties are yet foreseen for the choice of an automated selection system. Small scale cartography showing the agrarian countryside's structural features, is suggested. Author (ESA)

**N79-30641#** Technische Universitaet, Hanover (West Germany). Inst. fuer Photogrammetrie.

**CARTOGRAPHIC ASPECTS OF EARTH IMAGERY OBTAINED FROM SPACE**

Gottfried Konecny *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 255-261 refs

Avail: NTIS HC A99/MF A01

Requirements related to the mapping of images obtained from space are discussed. The interest in space photograph application to cartography derives from their faster evaluation vis a vis aerial photographs for the same area. Camera operations, as they are being planed for the Spacelab-1 experiment payload are expected to meet the requirements for 1:250,000 and marginally for 1:50,000 mapping with respect to planimetry and resolution. Correction of the geometric distortions of LANDSAT multi-temporal multi-sensor images is proposed, including a geometric accuracy analysis of LANDSAT MSS imagery. Several examples of corrected photographs are given. Author (ESA)

**N79-30642#** Institut Geographique National, Paris (France).

**AUTOMATIC CARTOGRAPHY OF LINEAR OBJECTS [CARTOGRAPHIE AUTOMATIQUE DES OBJETS LINEAIRES]**

S. Braconne, F. Brun, and B. Fourcade *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 263-267 refs In FRENCH

Avail: NTIS HC A99/MF A01

Two methods of automatic cartography of linear elements, taken from LANDSAT images, are presented. One method uses the topological parameters of the sub-assemblies of image textures, attempting to characterize each sub-assembly by its shapes while looking only for linear shapes. The other method is based on the fact that the shade of gray of each pixel belonging to a linear element presents a large deviation from the average shade of the neighboring pixels, thus identifying the linear element. Results show that the topological method is adequate for the automatic identification for the important linear elements, such as highways. The method of linear anomaly works well for smaller subjects, but the increase in number may not be desirable in some cases. Author (ESA)

**N79-30692#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**DETERMINATION OF ASTRO-GEODETIC PLUMB LINE DEFLECTIONS AT PRIMARY TRIANGULATION POINTS IN GERMANY DURING THE PERIOD 1966 TO 1977 [DIE ASTROGEODAETISCHEN LOTABWEICHUNGSBESTIMMUNGEN DER ABTEILUNG 1 DES DEUTSCHEN GEODAETISCHEN FORSCHUNGSINSTITUTS AUF PUNKTEN DES DEUTSCHEN HAUPTDREIECKSNETZES IN DEN JAHREN 1966 BIS 1977]**

Klaus Kaniuth and Klaus Stuber Deut. Geodaetische Komm. 1978 32 p refs In GERMAN; ENGLISH summary

(Ser-B-299; ISBN-3-7696-8530-X) Avail: NTIS HC A03/MF A01

Plumb line deflections are determined in order to accurately calculate triangulation networks on a reference ellipsoid, to determine geoids, and to perform 3 dimensional calculations. These deflections were obtained from astronomical latitude and longitude determinations with zaiss Ni 2 astrolabes at 27 points in the triangulation network of Southern Germany. Tables of results are given adjusting horizontal measurements at the earth's surface to the reference ellipsoid. Author (ESA)

**N79-30695#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**THEORETICAL RESEARCH INTO THE ACCURACY OF THREE DIMENSIONAL POINT DETERMINATIONS OF THE EARTH'S SURFACE Ph.D. Thesis - Stuttgart Univ. [THEORETISCHE UNTERSUCHUNGEN UEBER DIE GENAUIGKEIT DER DREIDIMENSIONALEN TERRESTRISCHEN PUNKTBESTIMMUNG]**

Max Mayer Deut. Geodaetische Komm. 1978 169 p refs In GERMAN

(Ser-C/Diss-245; ISBN-3-7696-9299-3) Avail: NTIS HC A08/MF A01

Improvements on three dimensional network determination are considered. It is shown that three-dimensional points can be accurately determined in various coordinate systems from distance measurements, angles of elevation, astronomical latitudes and longitudes, and perhaps some additional information about directions. Relations are established between observations and parameters to be calculated. Mathematical models are developed to overcome the height and refraction problem; they are analyzed from an error point of view. Studies show to what extent the number of observations can be reduced without sacrificing accuracy. Author (ESA)

**N79-30696#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**A GEODETIC WORLD DATUM FROM TERRESTRIAL AND SATELLITE DATA Ph.D. Thesis - Bonn Univ. [EIN GEODAETISCHES WELTDATUM AUS TERRESTRISCHEN UND SATELLITEDATEN]**

Bernd Eitschberger Deut. Geodaetische Komm. 1978 188 p refs In GERMAN

(Ser-C/Diss-245; ISBN-3-7696-9300-0) Avail: NTIS HC A09/MF A01

An analytical description of the earth's surface based on a reference ellipsoid is developed. The earth's gravitational field, deduced from measurements, is expressed as a potential series. Suitable adjustments enable an approximate description of the earth's surface to be obtained in terms of equipotential surfaces (quasi-geoids). An ellipsoid, which corresponds in both an overall and local manner to the earth's surface is then equated to these surfaces. The mathematical treatment of data leading to optimized parameters defining an axisymmetric or triple axed elipsoid is described. The accuracy obtainable with this method is critically examined. Author (ESA)

**N79-31864*#** National Aeronautics and Space Administration, Washington, D. C.

**APPLICATION OF SPACE TECHNOLOGY TO CRUSTAL DYNAMICS AND EARTHQUAKE RESEARCH**

Aug. 1979 274 p refs

(NASA-TP-1464) Avail: NTIS HC A12/MF A01 CSCL 08K

In cooperation with other Federal government agencies, and the governments of other countries, NASA is undertaking a program of research in geodynamics. The present program activities and plans for extension of these activities in the time period 1979-1985 are described. The program includes operation of observatories for laser ranging to the Moon and to artificial satellites, and radio observatories for very long baseline microwave interferometry (VLBI). These observatories are used to measure polar motion, earth rotation, and tectonic plate movement, and serve as base stations for mobile facilities. The mobile laser ranging and VLBI facilities are used to measure crustal deformation in tectonically active areas. G.Y.

**N79-31865#** European Space Agency, Paris (France).
**DEFINITION OF A EUROPEAN PROGRAM FOR EARTHQUAKE PREDICTION RESEARCH**
T. D. Guyenne, ed. Apr. 1979 97 p refs Presented at ESA/Council of Europe Seminar, Strasbourg, 5-7 Mar. 1979
(SP-149) Avail: NTIS HC A05/MF A01

The-state-of-the-art concerning earthquake prediction is reviewed in a series of 16 lectures covering different fields, such as national programs for earthquake monitoring and prediction, space techniques in earthquake prediction research, error analysis of geodetically derived strains, real-time monitoring and data acquisition, and strain and tilt measurements in seismic areas.

**N79-31868#** Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.
**TERRESTRIAL AND SPACE TECHNIQUES IN EARTHQUAKE RESEARCH**
Andreas Vogel *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 11-15

Avail: NTIS HC A05/MF A01

A report is given on an international workshop which was held to discuss recent advances in experimental techniques for the monitoring of crustal dynamics in earthquake zones. Experts from countries throughout the world, who are concerned with earthquakes and earthquakes disaster prevention, participated and discussed various terrestrial as well as space techniques presently applied or most likely to become applicable in earthquake prediction research. It is proposed that the discussion of instrumental capabilities and natural limitations, the presentation of world-wide experiences and results of recent research, and the conclusions and future aspects documented in the proceedings of the workshop should be evaluated to provide a basis for an European research program on earthquake prediction and disaster prevention. Author (ESA)

**N79-31869#** Paris-Sud Univ., Orsay (France).
**FRENCH PROGRAM FOR THE STUDY OF SEISMIC RISK [PROGRAMME FRANCAIS D'ETUDE DU RISQUE SISMIQUE]**
Claude Froidevaux *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 17-18 refs In FRENCH
Avail: NTIS HC A05/MF A01

The conclusions of a working group coordinating the research of French laboratories on the problems of earthquake tectonics and earthquake generating processes in relation to seismic risk are presented. The outcome is an increased interest in the use of satellites in photographing the main buckling of the earth's crust, and to retransmit the data of seismological observatories. However, the necessity of including detailed ground studies by tectonic methods, providing analysis of active or recent geological faults in terms of regional tectonic constraints is emphasized. These constraints should also be measured directly in order to get a quantitative understanding of intracontinental buckling.
Author (ESA)

**N79-31870#** Technische Universitaet, Darmstadt (West Germany). Inst. of Physical Geodesy.
**APPLICATION OF GEODETIC TECHNIQUES IN EARTHQUAKE PREDICTIONS**
Erwin Groten *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 19-20 refs

Avail: NTIS HC A05/MF A01

Various gravimetric techniques are proposed along with other geodetic techniques such as leveling and space techniques to supplement present geophysical methods of earthquake prediction. Geodetic methods seem to be advantageous in large scale studies. The exact regression of height variations with gravity variations in time provides an additional source of information besides dilatancy. Teleseismic approaches do not yet seem to have sufficient reliability and supplementary methods are still needed. Author (ESA)

**N79-31872#** Athens Univ. (Greece). Higher Geodesy and Cartography.
**ON THE ERROR ANALYSIS OF GEODETICALLY DERIVED STRAINS IN SEISMIC ZONES**
E. Livieratos *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 27-32 refs Prepared in cooperation with Triest Univ., Italy

Avail: NTIS HC A05/MF A01

The possibility of computing strain quantities in seismic zones by using geodetic methods and results is illustrated. The finite element method for the computation of the plane strain tensor concerning the displacements of a geodetic triangle is followed by an error analysis of the geodetically extracted strain rates with respect to the uncertainties of the geodetic results. An actual example of the importance and validity of the maximum shear strain computations at seismic zones shows the potentialities of the geodetic methods. Author (ESA)

**N79-31875#** Bureau de Recherches Geologiques et Minieres, Orleans (France).
**ASSESSMENT OF EARTHQUAKE HAZARDS IN FRANCE WITH SPECIAL REFERENCE TO REMOTE SENSING DATA**
C. Weber, J. Vogt, and G. Weecksteem *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 47-55 refs
Avail: NTIS HC A05/MF A01

Seismotectonic mapping is considered as the basis of analysis of seismic hazards and earthquake forecasting. It requires a correlation of a large range of data. The map prepared in France is the synthesis of six thematic maps (especially an instrumental and macroseismic map), whose characteristics are given. However, emphasis is put on lineaments from satellite imagery, whose significance is discussed. They should be considered as an important element of a multidisciplinary approach to the evaluation of seismic hazards. Provided a given interpretation procedure is used, lineaments are an important contribution to solving neotectonic problems and to detecting possible active faults, especially when fair correlations with epicenters exist. A certain coherence already appears with the distribution of stress fields. These results encourage field controls and seismological monitoring. Author (ESA)

**N79-31879#** Academy of Sciences (USSR), Moscow Inst. of Physics of the Earth.
**PATTERN RECOGNITION IN EARTHQUAKE-BORNE AREAS IN ITALY**
V. Keilis Borok, E. Oficerova, E. Ranzman, I. Rotwain, A. Solofjef, and A. Caputo (Rome Univ.) *In* ESA Definition of a European Problem for Earthquake Prediction Res. Apr. 1979 p 67-68
Submitted for publication

Avail: NTIS HC A05/MF A01

In accordance with the map of lineaments of the Italian region, the intersections of the lineaments where one may expect strong earthquakes to occur, were determined. The parameters used for the pattern recognition method are mostly based on elevation and slope. Many control experiments were made to test the validity and the stability of the results obtained. The results show several locations where strong earthquakes have not occured in historic times, and may occur in the future.
Author (ESA)

**N79-32769#** Ohio State Univ., Columbus. Dept. of Geodetic Sciences.

**A GLOBAL 1 DEG. x 1 DEG. ANOMALY FIELD COMBINING SATELLITE, GEOS-3 ALTIMETER AND TERRESTRIAL ANOMALY DATA**

Tichard H. Rapp Hanscom AFB, Mass. AFGL Sep. 1978 20 p refs
(Contract F19628-76-C-0010)
(AD-A064740; AFGL-TR-78-0282; Rept-278; SR-22) Avail: NTIS HC A02/MF A01 CSCL 04/1

A method for combining satellite derived potential coefficient, mean 1 deg x 1 deg anomalies derived from the Geos-3 altimeter data, and mean 1 deg x 1 deg anomalies estimated from terrestrial gravity data is described. The combination procedure is designed to obtain an adjusted set of potential coefficients and an adjusted set of 64800 1 deg x 1 deg mean anomalies. The adjusted anomalies can be developed into potential coefficients to as large a degree as is reasonable considering the 1 deg x 1 deg data. Such anomalies will be exactly consistent with the adjusted potential coefficients. G.Y.

**N79-33232*** National Aeronautics and Space Administration, Washington, D. C.

**SATELLITE TO STUDY EARTH'S MAGNETIC FIELD**

19 Oct. 1979 34 p
(NASA-News-Release-79-129; P79-10131) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The Magnetic Field Satellite (Magsat) designed to measure the near earth magnetic field and crustal anomalies is briefly described. A scalar magnetometer to measure the magnitude of the earth's crustal magnetic field and a vector magnetometer to measure magnetic field direction as well as magnitude are included. The mission and its objectives are summarized along with the data collection and processing system. J.M.S.

**N79-33528*#** Massachusetts Inst. of Tech., Cambridge.

**TECTONIC STRESS: MODELS AND MAGNITUDES**

S. C. Solomon, R. M. Richardson (Arizona Univ., Tucson), and E. A. Bergman, Principal Investigators 2 Aug. 1979 32 p refs Presented at USGS Conf. on the Magnitude of Deviatoric Stresses in the Earth's Crust and Upper Mantle, Carmel, Calif., 29 Jul. - 2 Aug. 1979 ERTS
(Grants NsG-7329; NSF EAR-74-21894; NSF EAR-78-12936)
(E79-10296; NASA-CR-162327) Avail: NTIS HC A03/MF A01 CSCL 08G

**N79-33683*#** National Aeronautics and Space Administration. Goddard Space Flight Center Greenbelt, Md.

**PROPOSED SATELLITE LASER RANGING AND VERY LONG BASELINE INTERFEROMETRY SITES FOR CRUSTAL DYNAMICS INVESTIGATIONS**

P. D. Lowman, R. J. Allenby, and H. V. Frey Sep. 1979 71 p refs
(NASA-TM-80563, Rept-922) Avail: NTIS HC A04/MF A01 CSCL 08G

Recommendations are presented for a global network of 125 sites for geodetic measurements by satellite laser ranging and very long baseline interferometry. The sites were proposed on the basis of existing facilities and scientific value for investigation of crustal dynamics as related to earthquake hazards. Tectonic problems are discussed for North America peripheral regions and for the world. The sites are presented in tables and maps, with bibliographic references. R.E.S.

## 04

# GEOLOGY AND MINERAL RESOURCES

**Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.**

**A79-46580** **Simultaneous use of geological, geophysical, and LANDSAT digital data in uranium exploration.** A. Missallati, A. E. Prelat, and R. J. P. Lyon (Stanford University, Stanford, Calif.). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 189-210. 14 refs. Research sponsored by the Alfateh University.

The simultaneous use of geological, geophysical and Landsat data in uranium exploration in southern Libya is reported. The values of 43 geological, geophysical and digital data variables, including age and type of rock, geological contacts, aeroradio-metric and aeromagnetic values and brightness ratios, were used as input into a geomathematical model. Stepwise discriminant analysis was used to select grid cells most favorable for detailed mineral exploration and to evaluate the significance of each variable in discriminating between the anomalous (radioactive) and nonanomalous (nonradioactive) areas. It is found that the geological contact relationships, Landsat Bands 6 and Band 7/4 ratio values were most useful in the discrimination. The procedure was found to be statistically and geologically reliable, and applicable to similar regions using only the most important geological and Landsat data. A.L.W.

**A79-47554 *** **Geologic interpretation from composited radar and Landsat imagery.** M. I. Daily (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, Santa Barbara, Calif.), T. Farr, C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and G. Schaber (U.S. Geological Survey, Branch of Astrologic Studies, Flagstaff, Ariz.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1109-1116. 13 refs. U.S. Geological Survey Contract No. W-13576; Contract No. NAS7-100.

Dual polarization L-band (lambda = 25 cm) radar imagery and Landsat multispectral scanner (MSS) data from central Death Valley have been computer processed and combined digitally in order to utilize the complementary information contained in multisensor data sets. Physically, like-polarized radar data gives roughness information on a scale proportional to radar wavelength. Cross-polarized data adds information on the overall roughness, particle shape, and packing density. Visible and near IR reflectivities pertain to surface chemistry. Surficial geologic units in Death Valley are defined on the basis of compositional and textural differences: optical and microwave scattering properties encoded in the multisensor image are sufficient to discriminate most of the units. This synergistic effect is most pronounced for the alluvial fans. Using radar scattering data and measured sun angle, passively-sensed (passive microwave, visible, near IR) images can be corrected for shadowing effects. (Author)

**A79-48457** **Potential for near ultraviolet spectral data to delineate geologic materials.** L. H. Alger (Indiana State University, Terre Haute, Ind.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 379-389. 9 refs. (ASP 79-149)

Near ultraviolet spectral data (0.33-0.38 micron) were analyzed independently and multispectrally with visible and near infrared spectral data for the purpose of delineating selected surficial geologic materials and particle size groups. Specific capabilities of the near ultraviolet band were determined via implementation of data conversion techniques employing the algebraic combination of two bands to produce a third. Results demonstrated that near ultraviolet data (1) can, in a multispectral approach, delineate selected geologic particle size groups; and (2) was the only band capable of identifying unweathered, recent basalt features. (Author)

**A79-48467 *** **Development of a tree classifier for discrimination of surface mine activity from Landsat digital data.** J. L. Solomon, W. F. Miller, and D. A. Quattrochi (Mississippi State University, Mississippi State, Miss.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 607-613. 5 refs. Grant No. NGL-25-001-054. (ASP 79-208)

In a cooperative project with the Geological Survey of Alabama, the Mississippi State Remote Sensing Applications Program has developed a single purpose, decision-tree classifier using band-ratioing techniques to discriminate various stages of surface mining activity. The tree classifier has four levels and employs only two channels in classification at each level. An accurate computation of the amount of disturbed land resulting from the mining activity can be made as a product of the classification output. The utilization of Landsat data provides a cost-efficient, rapid, and accurate means of monitoring surface mining activities. (Author)

**A79-48522 *** **The grabens of Canyonlands National Park, Utah - Geometry, mechanics, and kinematics.** G. E. McGill and A. W. Stromquist (Massachusetts, University, Amherst, Mass.). *Journal of Geophysical Research,* vol. 84, Aug. 10, 1979, p.4547-4563. 25 refs. Grant No. NGR-22-010-076.

Results are reported for three years of field and analytical study of a system of young and very well exposed grabens in southeastern Utah. A kinematic and mechanical model is developed for these specific grabens with the hope that this will aid in interpreting graben systems elsewhere on the earth and other planets. Because studies on other planets must be based entirely on photo analysis, an attempt is made to determine to what extent three-dimensional geometry could be inferred from photographs alone. An equation based on the model of graben geometry and kinematics relates thickness of faulted plates to graben parameters measurable on photographs. The initial width of a nascent graben is a simple function of the dip of the faults bounding the graben and of the thickness of the faulted brittle plate. The uniform spacing of the grabens is a natural result of the geometry of the system. S.D.

**A79-50221** **Remote sensing and landform analysis.** B. F. Richason, III (St. Cloud State University, St. Cloud, Minn.). *Remote Sensing Quarterly,* vol. 1, Apr. 1979, p. 44-48.

The application of remote sensing imagery and techniques to geology-physiography is discussed. Uses of and information obtainable from remote sensing imagery are considered, and attention is given to interpretative techniques utilizing stream patterns and densities, shadows, tone, aerial photomosaics and multi-scale photography. Types of imagery used for geologic-physiographic studies, including black and white panchromatic and infrared photography, conventional and infrared color aerial photography, multispectral and thermal infrared scanning and microwave radar are also presented. A.L.W.

**A79-53586 #** **Land gravimetry.** W. E. Strange (NOAA, National Geodetic Survey, Rockville, Md.) and L. E. Wilcox (U.S. Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1380-1387. 65 refs.

The major activities of U.S. governmental organization in land gravimetry are reviewed. The NGS, NOAA, USGS, DOE, NRC, DoD, and AFGL work is included, and recent developments provided accurate portable absolute gravity measurement devices, new gravity surveys and anomaly maps, and a helicopter gravity measuring system. Absolute gravity measurement, the analysis of base networks and gravity standards, land gravity surveys and gravity mapping activities, gravity depository activities, secular changes in gravity, and new measurement techniques including the cryogenic tidal gravimeter and the rotating gravity gradiometer are described. It is concluded that a complete listing of the new land gravity survey work can be obtained in the Quarterly Accessions List of the DoD Gravity Library. A.T.

**N79-28637*#** Geological Survey, Menlo Park, Calif.
**DETECTION AND MAPPING OF HYDROTHERMALLY ALTERED ROCKS IN THE VICINITY OF THE COMSTOCK LODE, VIRGINIA RANGE, NEVADA, USING ENHANCED LANDSAT IMAGES**
R. P. Ashley, Principal Investigator, A. F. H. Goetz (JPL), L. C. Rowan (Geological Survey, Reston, Va.), and M. J. Abrams (JPL) 1979 46 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10223; NASA-CR-158749; Rept-79-960) Avail: NTIS HC A03/MF A01 CSCL 08G

The author has identified the following significant results. LANDSAT images enhanced by the band-ratioing method can be used for reconnaissance alteration mapping in moderately heavily vegetated semiarid terrain as well as in sparsely vegetated to semiarid terrain where the technique was originally developed. Significant vegetation cover in a scene, however, requires the use of MSS ratios 4/5, 4/6, and 6/7 rather than 4/5, 5/6, and 6/7, and requires careful interpretation of the results. Supplemental information suitable to vegetation identification and cover estimates, such as standard LANDSAT false-color composites and low altitude aerial photographs of selected areas is desirable.

**N79-28825*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**BIBLIOGRAPHY OF GEOLOGIC STUDIES USING IMAGING RADAR**
M. Leonard Bryan 1 Jul. 1979 125 p Presented at NASA/JPL Radar Geology Workshop, Snowmass, Colorado, 16-20 Jul. 1979 Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158820; JPL-Pub-79-53) Avail: NTIS HC A06/MF A01 CSCL 08G

Articles concerning imaging studies on the geomorphology, mineralogy, and topology of various landforms are reported. One hundred and ninety citations are listed and an index by National Technical Information service citation number is included. Several illustrations of L-band radar imagery are presented. M.M.M.

**N79-29564** Delaware Univ., Newark.
**A TWO-LEVEL WEIGHTED FACTOR EVALUATION OF THE METALLIC MINERALIZATION POTENTIAL OF CENTRAL BAJA CALIFORNIA USING SATELLITE DATA AND COMPUTER-ASSISTED ENHANCEMENT TECHNIQUES Ph.D. Thesis**
Ralph Norbert Baker 1979 339 p
Avail: Univ. Microfilms Order No. 7918796

Remote sensor data (primarily LANDSAT) were analyzed by photogeologic and computer-assisted enhancement techniques to evaluate the metallic mineral potential of Baja California. Overlays were prepared at 1:1,000,000 and 1:500,000 and included known geologic relationships and mineral occurrences; lineament, drainage and structural patterns, tonal anomalies; and results of computer-assisted extractive processing. Computer-assisted enhancement and classification of the test sites was performed using multispectral image analysis system to identify subtle tonal anomalies thought related to mineralization using known sites as analysis guides. The probability for mineralization within the entire central Baja California study area was quantified using a weighted factor approach. Mineral potential maps of Baja California were generated from these analyses. Dissert. Abstr.

**N79-29565** Stanford Univ., Calif.
**QUANTITATIVE RELATIONSHIPS OF SURFACE GEOLOGY AND SPECTRAL HABIT TO SATELLITE RADIOMETRIC DATA Ph.D. Thesis**
Stuart Emmet Marsh 1979 290 p
Avail: Univ. Microfilms Order No. 7917258

Integrating the sampling, correlation, and mixture research established the quantitative accuracy of the LANDSAT multispectral data for a variety of geologic terrains. Within defined contrast constraints, and after compensation is made for atmospheric attenuation and scattering, the system can accurately depict the spectral character of the Earth's surface. Dissert. Abstr.

**N79-29580#** Texas Instruments, Inc., Dallas.
**AERIAL RADIOMETRIC AND MAGNETIC RECONNAISSANCE SURVEY OF PORTIONS OF ARIZONA, NEW MEXICO. VOLUME 1: INSTRUMENTATION AND METHODS Final Report**
Nov. 1978 63 p refs
(Contract EY-76-C-13-1664)
(GJBX-23(79)-Vol-1) Avail: NTIS HC A04/MF A01

Instrumentation and methods are described for a high-sensitivity, aerial gamma ray spectrometer and magnetometer survey of the Mesa, Tucson, Nogales, Clifton, Silver City, and Douglas, NTMS, 1:250,000-scale quadrangles in southeastern Arizona and southwestern New Mexico. A Bell 212 helicopter equipped with gamma ray spectrometer and six large-volume sodium iodide detectors, two 400 channel analyzers, and ancillary geophysical and electronic equipment, and a DC-3 aircraft equipped with nine detectors were used. Gamma ray spectrometric data were processed to correct for variations in atmospheric, flight, and instrument conditions and were statistically evaluated to remove the effects of surface geologic variations. The resulting first-priority uranium anomalies were interpreted to evaluate their origin and significance. Results in the form of a preferred anomaly map, along with significance-factor profile maps, stacked profiles, and histograms, are presented. DOE

**N79-29584#** Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.
**A SELECTED BIBLIOGRAPHY: REMOTE SENSING TECHNIQUES FOR EVALUATING THE EFFECTS OF SURFACE MINING**
David M. Carneggie and Donald O. Ohlen 6 Mar. 1979 15 p refs
(Contract DI-14-08-0001-16439)
(PB-294299/3) Avail: NTIS HC A02/MF A01 CSCL 08I

Thirty-one citations of technical papers and other publications dealing with the monitoring surface mining are presented. These references summarize recent developments in methods used to identify, map, analyze, and monitor surface mining, particularly coal surface mining. GRA

**N79-30592*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**GEOLOGICAL FAULT ON A MILLIONTH SCALE, SAN FRANCISCO RIVER [FOLHA GEOLOGICA AOMILLIONESIMO, RIO SAO FRANCISCO]**
Nelson DeJesusParada, Principal Investigator, Paulo Roberto Meneses, Athos Ribeiro dosSantos, Ubiratan Porto dosSantos, Paulo Veneziani, and Chan Chiang Liu Sep. 1978 123 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10231; NASA-CR-158795) Avail: NTIS HC A06/MF A01 CSCL 08G

**N79-30593*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**GEOLOGIC APPLICATIONS OF THERMAL INERTIA IMAGE USING HCMM DATA Quarterly Report, Jan. - Mar. 1979**
Anne B. Kahle, Principal Investigator, Helen H. Paley, and Stuart E. Marsh 30 May 1979 7 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS7-100)

(E79-10232; NASA-CR-158796; HCM-028) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Comparison of a simulated HCMM image of the Pisgah Crater, California test site obtained from aircraft data with an image generated from the preliminary satellite data tape of the area indicates that the HCMM satellite data appears much as predicted by the simulation. Author

**N79-30598*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**USE OF AUTOMATIC EXTRACTION OF LANDSAT DATA DEFINING AREAS OF ILMENITE IN THE FOREST OF THE STATE OF PERNAMBUCO [USO DA CLASSIFICACAO AUTOMATICA DE DADOS DO SATELITE LANDSAT NA DEFINICAO DE AREAS DE ILMENITA PRIMARIA EN FLORESTA, PERNAMBUCO]**
Nelson deJesusParada, Principal Investigator, Sylvio de Queiros Mattoso, Waldir Renato Paradella, and Paulo Roberto Meneses Jan. 1979 35 p refs In PORTUGUESE; ENGLISH summary ERTS
(E79-10237; NASA-CR-158801; INPE-1415-RPE/003) Avail: NTIS HC A03/MF A01 CSCL 02F

The author has identified the following significant results. Classification results point out 600 alarm areas of high potentiality of titanium occurrence. Almost 80 of these 600 alarm areas were checked by field work, and in 56 of them, titanium occurrences were confirmed and four new ore deposits were found. Author

**N79-30599*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**REMOTE SENSORS APPLIED TO THE PROSPECTING OF THERMOMINERAL WATERS IN THE MUNICIPALITY OF CALDAS NOVAS-GOIAS [SENSORES REMOTOS APPLICADOS A PROSPECCAO DE AGUAS TERMOMINERAIS NO MUNICIPIO DE CALDAS NOVAS-GOIAS]**
Nelson deJesusParada, Principal Investigator, Paulo Veneziani, and Celio Eustaquio dosSanjos Jan. 1979 16 p refs In PORTUGUESE Sponsored by NASA ERTS
(E79-10238; NASA-CR-158802; INPE-1413-RPE/001) Avail: NTIS HC A02/MF A01 CSCL 08H

**N79-30625#** Bureau de Recherches Geologiques et Minieres, Minieres, Paris (France).
**EXAMPLES OF THE CONTRIBUTIONS OF TELEDETECTION TO MINING RESEARCH [ILLUSTRATION PAR L'EXEMPLE D'UN MODE D'APPUI ET D'INTERVENTION DE LA TELEDETECTION SPATIALE EN RECHERCHE MINIERE]**
Jean-Yves Scanvic *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 117-131 refs In FRENCH
Avail: NTIS HC A99/MF A01

LANDSAT satellite images of mountainous regions of France were used to study geological structures in order to define the potential teledetection for mining research. Several dozen circular structures were discovered, ten of which are discussed as typical examples. It was also found that the alignments observed in the satellite images correspond to the phenomena described by Hobbs. The correlations with previous data show several possible origins for the circular structures. It is concluded that teledetection can be very important for mining research planning.
Author (ESA)

**N79-30626#** Institut Francais du Petrole, Rueil-Malmaison.
**CONTRIBUTION OF LANDSAT IMAGES TO GEOLOGICAL PROSPECTING IN THE WESTERN MEDITERRANEAN REGION [CONTRIBUTION DES IMAGES LANDSAT A LA PROSPECTION GEOLOGIQUE DANS LES REGIONS DE LA MEDITERRANEE OCCIDENTALE]**
E. Hilali (Min. de l'Energie et des Mines, Rabac, Morocco), A. Demnati (Min. de l'Energie et des Mines, Rabac, Morocco), J. C. Rivereau, and B. Soulhol *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 133-140 refs In FRENCH
Avail: NTIS HC A99/MF A01

Several morphostructural studies were carried out using LANDSAT images in order to provide techniques complementary to other methods of geological research. A local example for the region of Palomares in the southeast of Spain shows a good correlation between the surface and subsurface geology and one interpretation of the contours. At a regional level, in the zone of the Gibraltararc, a simultaneous study of the contours on earth and of the sea bathimetry permitted the formulation of a coherent structural model. It is concluded that the study of the contours can be used to formulate these models.
Author (ESA)

**N79-30628#** Milan Univ. (Italy). Cattedra di Fisica Terrestre.
**LANDSAT IMAGE ANALYSIS IN THE FIELD OF REGIONAL GEOLOGY: THE LIGURIAN ARC**
C. M. Marino *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 147-153 refs Original contains color illustrations

Avail: NTIS HC A99/MF A01

Two geological research projects were undertaken in a test area located in northern Italy, using LANDSAT 2 satellite data. Landslide hazard detection was investigated based on the analysis of selected parameters from LANDSAT 2 images. Many landslide areas characterized by marine silts and clays were found along the northern Appennines range. The geological structures, with special references to linear phenomena, were studied in the selected zone. Unclassified lineaments (17%) were found and from a sample of eight measured in situ, six showed positive tectonic response. Author (ESA)

**N79-30635#** Geosat Committee, Inc., San Francisco, Calif.
**GEOSAT PROGRAM 1978: FUTURE GEOLOGICAL REMOTE SENSING FROM SPACE**
F. B. Henderson *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 217-224 refs
Avail: NTIS HC A99/MF A01

The Geosat committee's objectives and the Geosat program are explained. Formed in 1976, with the support of 100 exploration and engineering companies, the Geosat committee suggested the use of supplementary sensing systems to optimize geological remote sensing from space within the NASA LANDSAT program. The recommendations include the use of rock/soil sensitive spectral bands, worldwide high resolution film, LANDSAT compatible digital stereoscopic imaging data, and synthetic aperture radars. Some Geosat required data may become available from France's SPOT, Japan's EARTH, Germany's ARGUS and other non-US. earth remote sensing satellites. Author (ESA)

**N79-30638#** Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
**APPLICATION OF DIGITAL IMAGE PROCESSING MODULES TO LANDSAT SCENES FOR THEIR IMPROVEMENT AND GEOLOGICAL EVALUATION**
P. Hoppe and K. A. Ulbricht *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 237-241 refs Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Ger.

Avail: NTIS HC A99/MF A01

The application of DIBIAS (Digital Image Processing System) to geological questions and problems was tested using LANDSAT image tapes. It was possible to obtain multispectral ortho-images of large areas of the earth by using the two LANDSAT satellites. Images were taken repetitively in six to twelve day sequences at the same time in the morning. This allows combination and comparison of images from different orbits for geoscientific interpretation. Results for a test area in Morocco and another in

Sudan are discussed. In Morocco, supervised and unsupervised classifications produced unsatisfactory results because the existing vegetation led to misinterpretation by changing and disturbing the spectral reflectance of the ground. Author (ESA)

**N79-30685#** Bendix Field Engineering Corp., Grand Junction, Colo.
**HELICOPTER-ASSISTED RADIOMETRIC SURVEY OF THE DIXON ENTRANCE QUADRANGLE, ALASKA**
W. A. Burgett and K. J. Krause Feb. 1979 11 p refs
(Contract EY-76-C-13-1664)
(GJBX-19(79)) Avail: NTIS HC A02/MF A01

Known uraniferous rocks at Bokan Mountain were well expressed radiometrically, and the type of survey conducted is capable of detecting similar geologic environments that might exist at the surface elsewhere in the quadrangle. No similar uraniferous environments were indicated, however. Strong radiometric (eU) anomalies were detected in a limestone terrane in which uranium is not generally expected to occur in anomalous concentrations. DOE

**N79-30689#** Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
**POLAR CONSTITUENTS OF A SHALE OIL: COMPARATIVE COMPOSITION WITH OTHER FOSSIL-DERIVED LIQUIDS**
I. B. Rubin, N. A. Goeckner (University of Western Ill., Macomb), and B. R. Clark 1979 22 p refs Presented at the Oil Shale Symp., Denver, 26 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790334-2) Avail: NTIS HC A02/MF A01

Similarities and differences in the polar portions of a variety of types of fossil fuel oils including oil from shale, from several coal liquefaction processes and from a mixture of natural petroleum crudes are described. Samples were fractionated by acid/base distribution as well as by gel partition chromatography which was then followed by acid/base distribution and adsorption chromatography. One subfraction of particular interest was that obtained from the hydrophilic fraction after gel partition chromatography, extracted into a neutral subfraction, and then eluted from an alumina column by methanol. This subfraction was not gas chromatographable, and was partially characterized by elemental analysis, NMR spectroscopy and infrared spectrophotometry. DOE

**N79-30703#** Arizona State Univ., Tempe. Dept. of Geology.
**GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES Final Report**
Elizabeth Babcock, Philip Briggs, Kenneth DeCook, Lock Ethridge, Kennith Foster, Charles Glass, and Robert Schowengerdt Apr. 1979 103 p refs Prepared in cooperation with Arizona Univ., Tucson and Arizona Water Comm., Phoenix
(Contract DI-14-34-0001-8060)
(PB-294816/4; W79-06164; OWRT-B-066-ARIZ(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Photolineaments of the entire northeast quadrant of Arizona were mapped from standard EROS Data Center false color LANDSAT composites. In addition, photolineaments were mapped using computer enhanced LANDSAT imagery of two intensive study sites. A third source of geologic structure data were existing large scale lineament maps derived from aerial photography of the study sites. Results indicate that LANDSAT imagery may be used to survey large areas for lineaments, and to cue the hydrogeologist to promising regions, which can then be mapped at aerial photography scales. GRA

**N79-30709#** HRB-Singer, Inc., State College, Pa.
**INVESTIGATION OF COLOR AND COLOR INFRARED AERIAL PHOTOGRAPHIC TECHNIQUES FOR MINING AND RECLAMATION PLANNING AND MONITORING Open File Report, 30 May 1975 - 28 Apr. 1978**
William M. Knuth, Eric L. Fritz, and James A. Schad 29 Sep. 1978 215 p refs
(Contract DI-BM-JO-155041)
(PB-294707/5; HRB-4936-F; BM-OFR-37-79) Avail: NTIS HC A10/MF A01 CSCL 08I

The technical and economical feasibility of using color and color infrared aerial photography to satisfy some informational needs for premine planning, mine progress monitoring, and reclamation monitoring was evaluated. Interpretability accuracies were also evaluated for parameters in the broad categories of land use, soils, water, vegetation, and geology. Seasonal interpretation characteristics were noted for infrared photography. Man hours for photointerpretation and costs of aerial data collection were monitored closely and incorporated into a cost benefit analysis. GRA

**N79-31111*** National Aeronautics and Space Administration, Washington, D. C.
**A BIBLIOGRAPHY OF PLANETARY GEOLOGY PRINCIPAL INVESTIGATORS AND THEIR ASSOCIATES, 1978 - 1979**
Joseph M. Boyce, comp. Aug. 1979 83 p
(NASA-TM-80540) Avail: NTIS HC A05 CSCL 03B

Approximately 450 articles on planetary geology are reported. M.M.M.

**N79-31708*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**GEOLOGICAL MAP OF PARTS OF THE STATE OF SAO PAULO BASED ON LANDSAT IMAGES [MAPA GEOLOGICO DE PARTE DO ESTADO DE SAO PAULO BASEADO EN IMAGENS LANDSAT]**
Nelson deJususParada, Principal Investigator, Gilberto Amaral, Chan Chiang Liu, and Raimundo Almeida Filho Mar. 1979 33 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E79-10240; NASA-CR-158804; INPE-1437-RPE/012) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. Interpretation of LANDSAT images revealed the subdivision of the Bauru formation into three distinct lithofacies. Delineation of structural features yielded new information on paleoenvironmental reconstitution and hydrogeology. Structural features and photogeological units were revealed in the precambrian basement at the eastern portion of the state.

**N79-31709*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**USE OF THE AUTOMATIC CLASSIFICATION OF LANDSAT DATA ON THE DEFINITION OF AREAS OF PRIMARY ILMENITE IN FLORESTA, PERNAMBUCO**
Nelson deJesusParada, Principal Investigator, Sylvio deQueiros-Mattos, Waldir Renato Paradella, and Paulo Roberto Menezes Jan. 1979 25 p refs In PORTUGUESE Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10249; NASA-CR-158857; INPE-1415-RPE/003) Avail: NTIS HC A02/MF A01 CSCL 02F

**N79-31712*#** Stanford Univ., Calif. Dept. of Geology.
**HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA**
Ernest I. Rich, Principal Investigator 21 Jul. 1979 3 p refs ERTS
(Contract NAS5-24479)
(E79-10252; NASA-CR-158858) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. First-look qualitative geologic evaluation of day- and night-IR images discloses several en echelon linear features extending throughout the central part of the northern coast range in California, across the Mendocino triple junction and into southern Oregon. Preliminary examination of these features with respect to topographic expression, vegetation, sun angle and azimuth, and atmospheric conditions suggests that they may be related to the intracontinental plate boundary (Lake Mountain Fault zone of Herd) of the Humbolt Plate. The linear features, which cut across several climatic zones and differently vegetated regions are not confined to topographic valleys, but cross the ridges and valleys at varying angles. Lithology within the Great Valley Sequence can be detected on a few of the images; however, preliminary evaluation suggests that the thermal banding observed may be a function of sun azimuth or late-day sun angle. Soil moisture, related to lithologic composition cannot be ruled out at this time.

**N79-31716*#** Geological Survey, Denver, Colo.

### ALTERED ROCK SPECTRA IN THE VISIBLE AND NEAR INFRARED

Graham R. Hunt and Roger P. Ashley, Principal Investigators [1979] 57 p refs Sponsored by NASA ERTS
(E79-10256; NASA-CR-158862) Avail: NTIS HC A04/MF A01 CSCL 08G

The author has identified the following significant results. Visible and near-infrared (0.35 to 2.5 micron m) bidirectional reflection spectra recorded for a suite of well-characterized hydrothermally altered rock samples typically display well defined bands caused by both electronic and vibrational processes in the individual mineral constituents. Electronic transitions in the iron-bearing constituent minerals produce diagnostic minima near 0.43, 0.65, 0.85, and 0.93 micron m. Vibrational transitions in clay and water-bearing mineral constituents produce characteristic single or multiple features over limited spectral ranges near 1.4, 1.75, 1.9, 2.2, and 2.35 micron m. The most abundant feature-producing minerals present in these rocks are hematite, goethite, and alunite. Others frequently present are jarosite, kaolinite, potassium micas, pyrophyllite, montmorillonite, diaspore, and gypsum. The spectral region near 2.2 micron m is particularly important for detecting altered rocks by remote sensing.

**N79-31717*#** Geological Survey, Reston, Va.

### EVALUATION OF LANDSAT MULTISPECTRAL SCANNER IMAGES FOR MAPPING ALTERED ROCKS IN THE EAST TINTIC MOUNTAINS, UTAH

Lawrence C. Rowan and Michael J. Abrams, Principal Investigators (JPL) [1979] 136 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10257; NASA-CR-158863; Rept-78-736) Avail: NTIS HC A07/MF A01 CSCL 08G

The author has identified the following significant results. Positive findings of earlier evaluations of the color-ratio compositing technique for mapping limonitic altered rocks in south-central Nevada are confirmed, but important limitations in the approach used are pointed out. These limitations arise from environmental, geologic, and image processing factors. The greater vegetation density in the East Tintic Mountains required several modifications in procedures to improve the overall mapping accuracy of the CRC approach. Large format ratio images provide better internal registration of the diazo films and avoid the problems associated with magnifications required in the original procedure. Use of the Linoscan 204 color recognition scanner permits accurate consistent extraction of the green pixels representing limonitic bedrock maps that can be used for mapping at large scales as well as for small scale reconnaissance.

**N79-31718*#** Geological Survey, Reston, Va.

### DISCRIMINATION OF HYDROTHERMALLY ALTERED ROCKS ALONG THE BATTLE MOUNTAIN-EUREKA, NEVADA MINERAL BELT USING LANDSAT IMAGES

M. Dennis Krohn, Michael J. Abrams (JPL), and Lawrence C. Rowan, Principal Investigators [1979] 92 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10258; NASA-CR-158864) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. Limonitic alteration halos associated with two copper prophyry deposits were successfully mapped at Battle Mountain. Alteration halos from both a hypogene system at Copper Canyon and a supergene system at Copper Basin are recognizable in the composite. Both copper porphyry deposits are located in sedimentary rock units that commonly have ferruginous coatings; yet, in most cases, the hydrothermally derived limonite was distinguishable in the CRC from sedimentary limonite. Large format playback images with pixel sizes from 200 to 400 micron m provided details of spatial resolution and color separation unachievable on enlargements from 70 mm film chips. Details of the alteration halos could be resolved only in the large format images. Two aspects of the alteration halos of the porphyry copper deposits were not mapped on the CRC. The optimum CRC image for the area studied consists of MSS 4/5 as blue, MSS 4/6 as yellow, and MSS 6/7 as magenta using diazo films. The disseminated gold deposits at Gold Acres are not depicted in the CRC image.

**N79-31730*#** Stanford Univ., Calif. School of Applied Earth Sciences.

### GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION **Quarterly Report, 1 Nov. 1978 - 28 Feb. 1979**

R. J. P. Lyon and A. E. Prelat, Principal Investigators 28 Feb. 1979 2 p ERTS
(Contract NAS5-24232)
(E79-10273; NASA-CR-162094) Avail: NTIS HC A02/MF A01 CSCL 08B

**N79-31731*#** Stanford Univ., Calif. School of Applied Earth Sciences.

### GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION **Quarterly Report, 1 Mar. - 30 Jun. 1979**

R. J. P. Lyon and J. C. Broderick, Principal Investigators 30 Jun. 1979 2 p ERTS
(Contract NAS5-24232)
(E79-10274; NASA-CR-162095) Avail: NTIS HC A02/MF A01 CSCL 08B

**N79-31733*#** Consiglio Nazionale delle Ricerche, Milan (Italy).

### HEAT CAPACITY MAPPING MISSION (HCMM) PROGRAM **Progress Report**

Roberto Cassinis, Giovanni Maria Lechi, Principal Investigators, Pietro Alessandro Brivio, Alberto Marini, Renzo Moretti, and Eugenio Zilioli 25 Aug. 1979 20 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10276; NASA-CR-162097; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

**N79-31734*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

### GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA **Quarterly Report, Apr. - Jun. 1979**

Helen N. Paley and Anne B. Kahle, Principal Investigators Aug. 1979 4 p ERTS
(Contract NAS7-100)
(E79-10277; NASA-CR-162099) Avail: NTIS HC A02/MF A01 CSCL 08G

**N79-32807*#** Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.

### GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE **Progress Report, 1 Dec. 1978 - Feb. 1979**

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Feb. 1979 5 p Sponsored by NASA ERTS
(E79-10282; NASA-CR-162147) Avail: NTIS HC A02/MF A01 CSCL 08B

# 04 GEOLOGY AND MINERAL RESOURCES

**N79-33518*#** Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.

**GEOLOGIC APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Mar. - 31 May 1979**

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson May 1979 6 p Sponsored by NASA ERTS (E79-10279; NASA-CR-162144) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. After digitization, a noise rejection filter was applied to data obtained by USGS aircraft. An albedo image was formed by combining three bands of visible data. Along with the day and nighttime thermal data, the albedo image was used to construct a relative thermal-inertia image. This image, registered to a topographic base, shows there are thermal property differences in the vicinity of the contact between the Fort Union and Wasatch formations in the Powder River Basin, Wyoming.

## 05

## OCEANOGRAPHY AND MARINE RESOURCES

**Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.**

**A79-44343 *** **Multibeam synthetic aperture radar for global oceanography.** A. Jain (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Transactions on Antennas and Propagation*, vol. AP-27, July 1979, p. 535-538. Contract No. NAS7-100.

A single-frequency multibeam synthetic aperture radar concept for large swath imaging desired for global oceanography is evaluated. Each beam iilluminates a separate range and azimuth interval, and images for different beams may be separated on the basis of the Doppler spectrum of the beams or their spatial azimuth separation in the image plane of the radar processor. The azimuth resolution of the radar system is selected so that the Doppler spectrum of each beam does not interfere with the Doppler foldover due to the finite pulse repetition frequency of the radar system. (Author)

**A79-44676 * #** **The GEOS 3 project.** H. R. Stanley (NASA, Wallops Flight Center, Wallops Island, Va.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3779-3783.

The GEOS 3 project was designed to provide useful data for determining oceanographic and geophysical parameters. The project organization, experiment package, and mission profile are described, and results and conclusions are highlighted. They serve as background material for the detailed results presented in this special volume. Attention is given to Ocean geoid, sea state, quasi-stationary departures from the marine geoid, wind speed, and terrain and ice. S.D.

**A79-44682 *** **Oceanic geoid and tides derived from GEOS 3 satellite data in the Northwestern Atlantic Ocean.** I. J. Won (North Carolina State University, Raleigh, N.C.) and L. S. Miller (Applied Science Associates, Inc., Apex, N.C.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3833-3842. 10 refs. Contract No. NAS6-2810.

Two sets of GEOS 3 altimeter data which fall within about a 2.5-deg width are analyzed for ocean geoid and tides. One set covers a path from Newfoundland to Cuba, and the other a path from Puerto Rico to the North Carolina coast. Forty different analyses using various parameters are performed in order to investigate convergence. Profiles of the geoid and four tides, M2, O1, S2, and K1, are derived along the two strips. While the analyses produced convergent solutions for all 40 cases, the uncertainty caused by the linear orbital bias error of the satellite is too large to claim that the solutions represent the true ocean tides in the area. A spot check of the result with the Mode deep-sea tide gauge data shows poor agreement. A positive conclusion of this study is that despite the uncertain orbital error the oceanic geoid obtained through this analysis can improve significantly the short-wavelength structure over existing spherical harmonic geoid models. (Author)

**A79-44685 *** **The geoid spectrum from altimetry.** C. A. Wagner (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3861-3871. 18 refs.

Preliminary estimates of the global spectrum of the sea surface and geoid are made using altimeter data from the GEOS 3 and Skylab spacecraft. In all, the equivalent of about seven revolutions of data has served from the 'global' estimates. It is found that the power spectrum of the sea surface generally follows the expected values from Kaula's rule applied to the geoid. Analysis of overlapping altimetry arcs (and oceanographic data) reveals that the surface spectrum is dominated by the geoid to about 500 cycles, but the sea state departures are significant starting at about 250 cycles. At less than 500 cycles (40 km half-wavelength) the total power in the marine geoid may be negligible (much less than 20 cm). S.D.

**A79-44687 *** **GEOS 3 ocean geoid investigation.** S. M. Yionoulis, A. Eisner, V. L. Pisacane, H. D. Black, and L. L. Pryor (Johns Hopkins University, Applied Physics Laboratory, Laurel, Md.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3883-3888. 5 refs. Contract No. N00024-78-C-5384. NASA Task I.

A determination of the fine-scale sea surface topography in the GEOS 3 calibration area using the radar altimeter data is presented. Estimates of the north-south and east-west components of the deflections of the vertical as well as values of the geoidal heights are made. Three major stages of processing are used in obtaining the final results. The first two use pass processors; in the final stage the processor combines all the pass results to compute the final results. Comparison with a gravimetrically determined geoid for the calibration area, provided by the National Aeronautics and Space Administration, yielded a mean and standard deviation of 0.45 and 1.5 m, respectively. (Author)

**A79-44689 #** **Observation of sea surface topography with GEOS 3 altimeter data.** B. C. Douglas and P. D. Gaborski (NOAA, National Geodetic Survey, Rockville, Md.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3893-3896. 11 refs.

Surface truth data, including an empirical tide model, geoidal undulations, dynamic heights, and infrared imagery in the GEOS 3 Atlantic calibration area, have been compared with features in GEOS 3 altimeter profiles of sea surface height. The 5 arcmin x 5 arcmin gravimetric geoid computed by J. G. Marsh agrees with altimeter profiles to the level of the sea surface topography (about 50 cm). After removal of a low-degree polynomial the differences of collinear passes of altimeter data reveal apparent time-dependent ocean surface features. Some of these can be identified from the surface truth information, but others cannot be correlated with known features, probably owing to limitations of the surface truth data. Independent collinear pairs also indicate that the best of the many orbit computation models used to compute the GEOS 3 altitude ephemeris introduces a bias of about 1 m (rms) on a typical pass of altimeter data. (Author)

**A79-44698 *** **Monitoring of thickness changes of the continental ice sheets by satellite altimetry.** R. L. Brooks (EG & G Washington Analytical Services Center, Inc., Pocomoke City, Md.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3965-3968. Contract No. NAS6-2639.

Radar altimeter measurements from the GEOS 3 satellite are being utilized to define the topography of the southern Greenland ice sheet between latitudes 60 deg N and 65 deg N. The resultant elevations have been correlated with two geoceiver sites on the ice surface; the agreement is within a few meters. The internal repeatability of the altimeter-derived elevations has been assessed at the crossovers of the satellite ground tracks; the observed agreements vary from 0.07 to 3.10 m, intervening times being 1 day and 674 days, respectively. Improved knowledge of the temporal changes in the topographic expression of the continental ice sheets, via satellite altimetry, will significantly add to the understanding of glaciological and climatological processes. (Author)

**A79-44702** **Surface roughness slope density estimates for low sea state conditions.** G. S. Brown (Applied Science Associates, Inc., Apex, N.C.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 3987-3989. 6 refs.

Surface roughness slope density estimates for low sea state conditions have been obtained using data from the integrating samplers of the Geos 3 radio altimeter located at approximately 0.3 and 1 deg angle of incidence. The altimeter data imply that the joint slope density is closer to a Laplacian form than a Gaussian form. Under conditions of very low surface wind speed, the slopes of the surface roughness may deviate markedly from the Gaussian form, possibly because surface waves are troichoidal in shape. C.K.D.

**A79-44703** * # **Satellite altimeter measurements of sea state - An algorithm comparison.** L. S. Fedor, R. Guptill, C. L. Rufenach (NOAA, Wave Propagation Laboratory, Boulder, Colo.), T. W. Godbey (General Electric Co., Utica, N.Y.), J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada), G. S. Hayne (Applied Science Associates, Inc., Apex, N.C.), and E. J. Walsh (NASA, Wallops Flight Center, Applied Science Directorate, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3991-4001. 18 refs.

Six algorithms for extracting significant wave height from Geos 3 altimeter data have been compared using simulated Geos 3 data for a single long pass including a variety of sea states and for short segments in the vicinity of NOAA data buoys. The study included algorithms reported by Walsh (1979), Rufenach and Alpers (1978), Gower (1979), Godbey (1965), Fedor (1978) and a real-time model (Miller and Hayne, 1972). Individual differences in results obtained by the algorithms were small, and calculations were found to be in good agreement with surface truth data. C.K.D.

**A79-44704** * # **Extraction of ocean wave height and dominant wavelength from Geos 3 altimeter data.** E. J. Walsh (NASA, Wallops Flight Center, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4003-4010. 15 refs.

Some data from the Geos 3 satellite altimeter are examined in detail to demonstrate the techniques used for extracting wave height and skewness of the sea surface. The approach used in determining the dominant wavelength of the ocean waves is discussed. Improvements incorporated into the Seasat 1 altimeter as the result of experience with Geos 3 are described. C.K.D.

**A79-44705** * # **Geos 3 wave height measurements - An assessment during high sea state conditions in the North Atlantic.** C. L. Parsons (NASA, Wallops Flight Center, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4011-4020; Comments, p. 4027, 4028. 26 refs.

The sea state in the North Atlantic Ocean has been monitored in February, 1977 to obtain data for verification of Geos 3 radio altimeter wave form data. The altimeter sea state data were found to be in good agreement with in situ sea state measurements and with aircraft remote sensing measurements of wave height. The average difference between the supporting data and Geos 3 was 0.34 m, and the standard deviation 0.61 m. Contour maps of sea state constructed for large regions of the earth's oceans on the basis of Geos 3 altimeter measurements exhibited systematic differences from operationally available computerized maps. It is thought that the underestimation of significant wave height maxima in the operational maps and the underestimation of the speed of movement of oceanic cyclones may be due to basic errors in the output of atmospheric primitive-equation models. Because of the narrow swath width of the Geos-3 sensor, data from several satellite orbits must be combined to construct contour maps, leading to low values of significant wave heights. C.K.D.

**A79-44707** * **A brief summary of verification results for the spectral ocean wave model /SOWM/ by means of wave height measurements obtained by Geos 3.** W. J. Pierson and R. E. Salfi (City College, New York, N.Y.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4029-4040. 9 refs. Contract No. NAS6-2439.

Significant wave heights calculated using a computer-based spectral ocean wave model (Pierson et al., 1966; Salfi, 1974; Lazanoff and Stevenson, 1975) from meteorological data have been compared with significant wave heights measured by Geos 3 for 44 orbit segments obtained during 1975 and 1976. The model specifications were found to be biased too low. Discrepancies between calculated and measured wave heights are also attributable to the poor specifications of the winds over the northern hemisphere oceans. C.K.D.

**A79-45050** # **Radar survey of sea roughness from flight vehicles (Radiolokatsionnaia s'emka morskogo volneniia s letatel'nykh apparatov).** A. A. Zagorodnikov. Leningrad, Gidrometeoizdat, 1978. 240 p. 154 refs. In Russian.

Sea roughness is a serious obstacle in the construction of harbor structures and ocean drilling equipment, has a significant effect on ship movements and safety, and it inhibits operations of ship, shore, and aircraft radar installations. This monograph reviews the principles of airborne and spaceborne remote sensing of various sea roughness parameters, including two-dimensional spectra. The basic characteristics of wind-induced wave disturbances are investigated. Sea roughness is represented as a three-dimensional random space-time field with a Gaussian distribution of wave slopes. Amplitude and phase (Doppler) characteristics of centimeter and optical waves are analyzed and the results of wave measurements are given. The physical principles of two dimensional harmonic analysis of radar and optical images of the sea surface are presented. Finally, some methods of roughness measurement from satellites using remote sensing methods are described. A.T.

**A79-45618** # **Satellite observation of the sea ice boundary in the coastal region extending from Queen Maud Land to the Filchner shelfice (Satellitenbeobachtung der Seeisgrenze im Küstengebiet 'Königin-Maud-Land' bis 'Filchner-Schelfeis').** H. Gernandt (Aerologisches Observatorium, Lindenberg, East Germany). *Zeitschrift für Meteorologie,* vol. 29, no. 2, 1979, p. 127-131. In German.

The sea ice about the Antarctica exhibits strong annual variations of the outer sea ice boundary. In the present paper, the variation of the sea ice boundary in the Antarctic coastal region extending from 40 degrees East to 40 degrees West is studied on the basis of satellite photography over the period from November 1976 to January 1977. V.P.

**A79-45781** # **Regional-scale sea surface temperature determination from the geostationary environmental operational satellite.** G. A. Maul (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). In: Ocean thermal energy for the 80's; Ocean Thermal Energy Conversion Conference, 6th, Washington, D.C., June 19-22, 1979, Preprints. Volume 1.
Laurel, Md., Johns Hopkins University, 1979, p. 2C-2/1 to 2C-2/6. 12 refs.

Sea surface temperatures determined from the digital GOES data base require five steps for quantification: first, the data have to be remapped into a rectangular matrix. Second, using optional decision strategy, cloud-free pixels are identified from joint visible-infrared probability distributions. Third, atmospheric corrections for infrared radiative transfer are calculated from upper air soundings in the region of interest. Fourth, the corrected satellite data are least-squares adjusted to surface observations because the GOES data have no absolute blackbody reference calibration. Fifth, the data are composited and prepared for analysis of variability with application to OTEC thermal resource. Error analysis of this scheme suggests that the rms error for 10 km resolution surface temperature will be + or - 1 K or less. (Author)

**A79-45782** # **Large cold tongues in the eastern Gulf of Mexico and their potential effect to OTEC.** F. M. Vukovich (Research Triangle Institute, Research Triangle Park, N.C.). In: Ocean thermal energy for the 80's; Ocean Thermal Energy Conversion Conference, 6th, Washington, D.C., June 19-22, 1979, Preprints. Volume 1. Laurel, Md., Johns Hopkins University, 1979, p. 2C-3/1 to 2C-3/4.

A large, narrow, cold tongue was detected in May 1978, extending southward from the northern boundary of the Loop Current. Similar tongues were detected in the spring of 1977 and 1975. The 1977 intrusion was described by Vukovich, et al (1978). These tongues penetrate as far as 400 km southward, and persisted for as long as 73 days. They originated as meanders on the northern boundary of the Loop Current. Limited in situ data (one case study) has indicated that there is greater cooling in the subsurface layers than in the surface layers in the cold tongues. This, in fact, produced an increase in the vertical temperature difference, or enhancement of the OTEC resource. Further study is needed to provide more substantial statistics. (Author)

**A79-45845** # **Use of satellite-derived sea surface temperatures by cruising OTEC plants.** F. K. Hill and G. L. Dugger (Johns Hopkins University, Laurel, Md.). In: Ocean thermal energy for the 80's; Ocean Thermal Energy Conversion Conference, 6th, Washington, D.C., June 19-22, 1979, Preprints. Volume 2. Laurel, Md., Johns Hopkins University, 1979, p. 2C-4/1 to 2C-4/6.

The collection and use of satellite data on sea surface temperatures by cruising OTEC plants is reviewed. A 360,000 sq nautical mile tropical area near the equator with temperature differences of 22 to 23.9 C between surface and 900 m deep water is of particular interest to early OTEC plantship deployment. To attain the highest temperature, a plantship must cruise continually to seek out the warmest spot each month, and must know what course to follow in terms of increasing relative sea surface temperature. This temperature gradient can be obtained less expensively from satellite observations than from surface vessels or aircraft. Data supplied by the NOAA from the NODC files are compared to sea surface temperature data provided by ITOS/NOAA polar orbiting satellites. Comparison of satellite measurements with surface measurements indicates that the view from space provides the aereal coverage and the necessary resolution with respect to sea surface temperature gradients to navigate OTEC plantships to stay in the warmest water. A.T.

**A79-48197** **Shelf sea fronts' adjustments revealed by satellite IR imagery.** J. H. Simpson and D. Bowers (North Wales University College, Anglesey, Wales). *Nature,* vol. 280, Aug. 23, 1979, p. 648-651. 8 refs.

IR imagery from NOAA 5 has been used to study the movement of shelf sea fronts. After the elimination of tidal advection, the fronts show remarkable consistency of position and do not adjust to the strong semi-monthly variation in tidal stirring which indicates the operation of a feedback process in vertical mixing. (Author)

**A79-48461** **Aerial photography and seaplane reconnaissance to produce the first total distribution inventory of submersed aquatic vegetation in Chesapeake Bay, Maryland.** R. T. Macomber (Earth Satellite Corp., Washington, D.C.) and G. H. Fenwick (Johns Hopkins University, Baltimore, Md.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 498-503. (ASP 79-185)

**A79-48470** **A comparison of atmospheric correction methods used in airborne sea surface temperature mapping.** E. Wedler (Newfoundland, Memorial University, St. John's, Canada) and R. D. Worsfold (Remotec Applications, Inc., St. John's, Newfoundland, Canada). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 672-693. 25 refs. (ASP 79-217)

Six airborne radiation thermometer (ART) atmospheric correction methods are outlined. These methods are the Pickett correction method, the Weiss-Garnier correction method, the Muller correction method, the Saunders correction method, the Henderson-Frank correction method, and the AES correction method. The last four methods are compared in the form of sea surface temperature maps for a cold ocean environment. All the correction methods alter the original ART values. The Muller correction method consistently alters the original ART values by a fixed positive value, regardless of ART value or atmospheric conditions; it is invalid for the cold ocean environment. The Saunders and Henderson-Frank correction methods attempt to compensate for changes in environment conditions. The AES correction method appears to be the most sensitive over the range of original ART values and to changes in atmospheric conditions; it provides both positive and negative temperature corrections. S.D.

**A79-48750** # **Sea ice ridging over the Alaskan Continental Shelf.** W. B. Tucker, III, W. F. Weeks, and M. Frank (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). *Journal of Geophysical Research,* vol. 84, Aug. 20, 1979, p. 4885-4897. 24 refs. Research supported by the U.S. Bureau of Land Management.

Sea ice ridging statistics obtained from a series of laser surface roughness profiles are examined. Each set of profiles consists of six 200 km long flight tracks oriented approximately perpendicular to the coastline of the Chukchi and Beaufort seas. It was found that although there was a systematic variation in mean ridge height with season, with the highest values occurring in late winter, there was no systematic spatial variation in height at a given time. The number of ridges/km also are high during the late winter with the highest values occurring in Barter Island and Cross Island profiles. Finally, it is concluded that the main factors currently limiting the accurate prediction of the temporal recurrence of large pressure ridges are limited knowledge of the drift of near-shore ice and data that would permit the assessment of year to year variability in the number of ridges/km. M.E.P.

**A79-50041** * **Measure of Arctic Sea ice characteristics using microwave scatterometry.** B. L. Jackson, W. D. Stanley (Old Dominion University, Norfolk, Va.), and W. L. Jones, Jr. (NASA, Langley Research Center, Hampton, Va.). In: SOUTHEASTCON '79; Proceedings of the Region 3 Conference and Exhibit, Roanoke, Va., April 1-4, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 278-280.

Results from a radar scatterometer used in the NASA microwave remote sensing experiment off the Alaska north shore are presented. The experiment was performed to determine whether various radars could be used from aircraft to provide definitive measurement of ice parameters such as pressure ridge height and direction, ice age, and ice type. With the aircraft at 300 m altitude, the 13.9 GHz scatterometer measured the normalized radar cross section of the ice using a pencil beam horizontally polarized antenna which pointed at either nadir or 50 deg incidence angle. Simultaneous laser altimeter and stereo photography measurements are presented as the 'surface truth' for comparison with the radar measurements. The results demonstrate that the scatterometer backscattered power is modulated by ice features and that a correlation exists between the radar cross section and the 'surface truth' derived from these ancillary instruments. A.T.

**A79-50228** * **Growth mechanisms of 'Katie's Floeberg'.** S. A. Barrett and W. J. Stringer (Alaska, University, Fairbanks, Alaska). *Arctic and Alpine Research,* vol. 10, no. 4, 1978, p. 775-783. 7 refs. Contracts No. NOAA-03-5-022-55; No. NAS5-20959. NOAA Task 8.

The growth mechanism of the grounded ice feature on Hanna's Shoal, located at approximately 162 deg W, 72 deg N in the Chukchi Sea, has been analyzed using Landsat I and II satellite imagery. The primary mechanism of growth was deduced to be the formation of large wedges of ice against the upstream edge of the feature. These wedges of piled ice form in three stages and may or may not become permanently affixed to the core of the feature. Remains of these growth patterns can sometimes be seen in the interior of the feature on the satellite imagery. (Author)

**A79-50510** **The fourth dimension in ocean remote sensing.** R. E. Stevenson (California, University, La Jolla, Calif.). In: Space instrumentation for atmospheric observation; Region V Annual Conference, El Paso, Tex., April 3-5, 1979, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 51-56.

The techniques of real-time space oceanography are discussed using data from Skylab, the Apollo/Soyuz Test Project, and the Defense Meteorological Satellite. The relationship between the thermal ocean and the surface textural dynamics of the upper ocean layers is outlined. Consideration is given to the requirement for the reduction of data bits to acquire the resolution necessary for the tactical navy, and the necessity of transmitting satellite data through the atmosphere to a few receiving centers. It is noted that for the required scale, resolution, and timeliness, the space platform most usable is the Space Shuttle. V.T.

**A79-51699 *** **Modulation of centimetric waves by long gravity waves - Progress report on field and laboratory results.** O. H. Shemdin (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Turbulent fluxes through the sea surface, wave dynamics, and prediction. New York, Plenum Publishing Corp., 1978, p. 235-253; Discussion, p. 254, 255. 17 refs. NASA-supported research; NSF Grant No. OCE-76-02713; Grant No. NOAA-NG-29-72.

Results are presented from laboratory and field experiments on the modulation of short waves by long waves. The field study employed a wave follower capable of tracking ocean waves with frequencies less than 1.0 Hz and heights less than 2.0 m. A high-response laser-optical system was used to detect upwind-downwind and cross-wind slopes of short waves. The laboratory study was conducted with wind over periodic long waves. The laboratory findings are discussed and compared with laboratory radar measurements and also short wave measurements obtained in the field. It is found that long waves significantly modulate the short wave dispersion by their orbital velocity, and that demodulation is necessary if the data collected by remote sensors are to be compared to surface penetrating devices. The modulation level is weak for wavelengths in the range 2.76-3.30 cm. Other relevant results are also presented. S.D.

**A79-52795** **Oceanic whitecaps and sea state.** J. Wu (Delaware, University, Newark, Del.). *Journal of Physical Oceanography*, vol. 9, Sept. 1979, p. 1064-1068. 10 refs. NSF Grant No. OCE-77-26508.

Results of whitecap coverages of the ocean surface obtained by previous investigators in both the Atlantic Ocean and the Pacific Ocean are reanalyzed. The variation of coverage with wind velocity appears to be related to the rate of energy supplied by the wind. The coverage is also found to vary with stability conditions of the atmospheric surface layer. Empirical formulas are deduced for various sea states and stability conditions, and application of these formulas to remote sensing of marine wind velocity is discussed. (Author)

**A79-53225** **Satellite-tracked drifter in the Benguela Current System.** T. F. W. Harris (Cape Town, University, Rondebosch, Republic of South Africa) and L. V. Shannon (Department of Industries, Sea Fisheries Branch, Sea Point, Republic of South Africa). *South African Journal of Science*, vol. 75, July 1979, p. 316, 317. 8 refs. Research sponsored by the South African Committee for Oceanographic Research.

Investigation of the Benguela Current System by the satellite-tracked drifter is reported. A free floating spar buoy was released west of Cape Town and its movements were determined by fixes from NASA's Nimbus 6 satellite. The trajectory of the drifter superimposed on the surface dynamic isobars was divided into three sections: (1) between days 67 and 128, the mean direction was 328 deg and the mean velocity 24 cm/s, and the prevailing wind stress suggested that the eastward deflections from the mean course can be explained by westerly winds or the formation of coastal lows along the South West African coast, (2) between days 129 and 219 the mean direction was 300 deg and the mean drifter velocity dropped to 12 cm/s; and (3) between days 220 and 245 the drifter direction was more zonal (275 deg) and the velocity increased to 20 cm/s. A.T.

**A79-53367** **The design of a satellite-based system for coastal oceans monitoring.** H. M. Mooney (British Aerospace, Dynamics Group, Filton, England). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-232.* 15 p.

Current plans for a European remote sensing satellite program include proposals for a system designed to monitor the coastal regions of Europe and the world. The paper summarizes the main conclusions of a design study (Phase A) of the Coastal Oceans Monitoring Satellite System (COMSS). The key constraints to system design set at the beginning of the study are identified. Coastal oceans monitoring is discussed in terms of the need for monitoring, selected sensors and performance characteristics, mission requirements, and coastal and ocean image quality. Particular attention is given to major system elements, the space segment, the ground segment, and earth coverage characteristics. The system design aspects discussed represent a first step in the definition of the COMSS mission. It is clear that additional work is necessary on various design aspects of the identified payload and system elements. S.D.

**A79-53378** **Ocean color scanner observations in the North Sea.** H. van der Piepen, H. Helbig, G. Kritikos, M. Schroeder, R. Staetter (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany), and R. Doerffer (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, West Germany). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-254.* 8 p. 7 refs.

Dedicated multispectral image scanners of adequate sensitivity are capable of deriving various water parameters, provided suitable atmospheric-correction algorithms are available. During the second test flight of NASA's Space Shuttle, a modified version of NASA's ocean color scanner (OCS) will be flown above open ocean areas to test correction techniques that are being developed. The present paper deals with some results obtained with the OCS above the North Sea. V.P.

**A79-53379** **The significant application of LANDSAT data to monitoring of marine environment.** H. Ochiai (Toba Merchant Marine College, Toba, Japan). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-255.* 14 p.

The paper deals with an analog and digital analysis of LANDSAT MSS data and analog analysis of LANDSAT RBV data and the application of these data to the monitoring of effluents from the Kumano, Yoshino, and Ishikari rivers. A classification of the water mass in the Seto Inland Sea is given. V.P.

**A79-53591 * #** **Satellite altimetry.** H. R. Stanley (NASA, Wallops Flight Center, Wallops Island, Va.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1418-1421. 45 refs.

The present status of the instrumentation and applications of satellite altimetry are reviewed. The earth-orbiting altimeters launched thus far are all basically conventional monostatic tracking radars which make three fundamental measurements: (1) time of arrival (altitude), (2) shape (waveform sample gates), and (3) amplitude (automatic gain control). A comparison of the fundamental characteristics of the present altimeter systems is given, along with evaluation of the preliminary results of altimeter data collected by Seasat-1. The application results described are mainly from the analysis of approximately 1/3 of the 2000 hours of altimeter data obtained from GEOS-3 through October 1978. V.T.

**A79-53843 *** **On the remote detection of swell by satellite radar altimeter.** C. L. Parsons (NASA, Wallops Flight Center, Wallops Island, Va.). *Monthly Weather Review,* vol. 107, Sept. 1979, p. 1210-1218. 10 refs.

A technique is developed and discussed which utilizes only significant wave height and wind speed measurements available from the GEOS-3 radar altimeter in real time to locate swell dominated regions of the earth's oceans. It is shown that reasonable agreement exists between the GEOS-3 map of the North Atlantic for 24 February 1976 and a map produced from hindcasted values of sea and swell obtained from the Special Projects Branch of the National Weather Service. Only data presently available from existing satellite radar altimeters are needed to map those areas of the oceans dominated by swell. It is concluded that the example given indicates that the decision boundary developed in this study to distinguish swell-dominated seas is a realistic choice. M.E.P.

**N79-28645*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SEASAT-A SATELLITE SCATTEROMETER MISSION SUMMARY AND ENGINEERING ASSESSMENT REPORT**

James W. Johnson, Wendell H. Lee, and Leon A. Williams May 1979 146 p

(NASA-TM-80122) Avail: NTIS HC A07/MF A01 CSCL 08C

The SeaSat-A satellite was launched on June 26, 1978 and operated in orbit through October 9, 1978. The SeaSat-A satellite scatterometer ocean surface wind field sensor began taking data on July 10, 1978 with virtually continuous operation for 95-1/2 days. A review of mission events significant to the scatterometer and a report on the hardware and software engineering assessment are presented. G.Y.

**N79-28863*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SEA-SURFACE TEMPERATURE AND SALINITY MAPPING FROM REMOTE MICROWAVE RADIOMETRIC MEASUREMENTS OF BRIGHTNESS TEMPERATURE**

C. Blume Hans-Juergen, Bruce M. Kendall, and John C. Fedors Dec. 1977 29 p refs

(NASA-TP-1077; L-11763) Avail: NTIS HC A03/MF A01 CSCL 08J

A technique to measure remotely sea surface temperature and salinity was demonstrated with a dual frequency microwave radiometer system. Accuracies in temperature of 1 C and in salinity of part thousand for salinity greater than 5 parts per thousand were attained after correcting for the influence of extraterrestrial background radiation, atmospheric radiation and attenuation, sea-surface roughness, and antenna beamwidth. The radiometers, operating at 1.43 and 2.65 GHz, comprise a third-generation system using null balancing and feedback noise injection. Flight measurements from an aircraft at an altitude of 1.4 km over the lower Chesapeake Bay and coastal areas of the Atlantic Ocean resulted in contour maps of sea-surface temperature and salinity with a spatial resolution of 0.5 km. Author

**N79-30649#** Ecole Polytechnique, Palaiseau (France).

**DETERMINATION OF THE SURFACE TEMPERATURE OF THE SEA FROM RADIOMETRIC MEASUREMENT IN TWO ATMOSPHERIC WINDOWS [DETERMINATION DE LA TEMPERATURE DE SURFACE DE LA MER A PARTIR DE MESURES RADIOMETRIQUES DANS DEUX FENETRES ATMOSPHERIQUES]**

D. Imbault, N. A. Scott, and A. Chedin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 321-333 refs In FRENCH

Avail: NTIS HC A99/MF A01

A parametric procedure for determining the temperature of the sea surface from differential radiometric measurements is presented. An ARIES (Surface Emission Infrared Radiation Analyzer) was employed using the atmospheric windows 10.5 to 12.5 and 7.9 to 9.6 micrometers. A set of computer programs were utilized (1) to extract spectroscopic data from data banks, (2) to compute the atmospheric transmission line by line with direct integration in altitude and in frequency, and (3) to calculate the radiancies (attenuated sun radiancy and atmospheric energy emission) from which the equivalent temperature, seen, by a spaceborne or airborne radiometer can be obtained. Computerized simulations were performed. Results show that the procedure is sufficiently simple for rapid computation of sea temperature, even for real-time operation. Author (ESA)

**N79-30674#** Barcelona Univ. (Spain). Dept. Termologia.

**TECHNIQUE OF CALIBRATION ON REMOTE INFRARED SENSORS: APPLICATION TO OCEANOGRAPHIC PURPOSES**

J. I. Jimenez, J. E. Llebot, C. Romeu-Nedwed (Inst. de Invest.), and A. Ballester (Inst. de Invest.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 527-532 refs Sponsored by Comm. Nacl. de Investigation del Espacio (CONIE) Original contains color illustrations

Avail: NTIS HC A99/MF A01

A calibration technique for an infrared remote sensing system on board a research aircraft is described. The equipment includes an infrared line scanner (IRLS) operating in the 8 to 14 micrometer range, a Barness precision radiometer thermometer (PRT), and Hasselblad cameras with infrared filters. For the sea data, a marine unit with in situ temperature sensing instrumentation continuously recorded sea surface temperature while a CASA 212 aircraft flew over it. The PRT data were used as a calibration for the IRLS. Both remotely sensed data from the IRLS, calibrated following our method, and sea information are in good agreement. Three examples are given: temperature pattern in front of a nuclear power plant; temperature pattern at the Ebro fan; determination and location of fresh water sources at the south of Peniscola. Author (ESA)

**N79-30680#** Canada Centre for Remote Sensing, Ottawa (Ontario).

**BENEFITS OF SPACEBORNE REMOTE SENSING FOR OCEAN SURVEILLANCE**

A. K. McQuillan and Donald J. Clough (Waterloo Univ.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 585-596 refs

Avail: NTIS HC A99/MF A01

Cost effectiveness and cost benefit studies were carried out by the Canada Center for Remote Sensing to assess the potential contribution and value of satellite data in meeting Canada's expanding ocean information requirements. The potential role of satellites as part of a network of platforms providing surveillance data including satellites, aircraft, data buoys, ships and coastal stations is discussed. Analysis indicates that, considering only Canadian and ocean areas of responsibility, a single surveillance satellite system (including ground data handling) would provide almost 10 times as much aerial coverage as an aircraft system having the same annual cost. Results of potential benefits studies of the effect of improved weather, ice, and sea state environmental information on offshore petroleum production and transportation, fishing, and coastal as well as offshore transport activities based on a scenario for growth rates in these activities are presented. Author (ESA)

**N79-30707#** National Technical Information Service, Springfield, Va.

**REMOTE SENSING OF THE OCEAN. VOLUME 2, PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - May 1979**

Robena J. Brown Jun. 1979 107 p Supersedes NTIS/PS-78/0563; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446

(NTIS/PS-79/0585; NTIS/PS-78/0563; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Studies on remote sensing methods as they apply to ocean temperature, sea ice, marine biology, and sound and light transmission are described. (This updated bibliography contains 99 abstracts, 24 of which are new entries to the previous edition). GRA

**N79-30706#** National Technical Information Service, Springfield, Va.
**REMOTE SENSING OF THE OCEAN. PART 2: DYNAMICS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - May 1979**
Robena J. Brown Jun. 1979 172 p Supersedes NTIS/PS-78/0564; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75-447
(NTIS/PS-79/0586; NTIS/PS-78/0564; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Studies on remote sensing methods as they apply to ocean currents, wind sediment transport, ocean waves, sea states, and water interactions are presented. The various techniques of measurement are described. (This updated bibliography contains 166 abstracts, 23 of which are new entries to the previous edition). GRA

**N79-31714*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**FISHING CHARTS: A MODEL OF FISHING CHARTS UTILIZING OCEANOGRAPHIC DATA AND REMOTE SENSORS; AS APPLIED TO SARDINES, SARDINELLA BRASILIENSIS [CARTAS DE PESCA: UM MODELO DE CARTAS DE PESCA UTILIZANDO DADOS OCEANOGRAFICOS E DE SENSORIAMENTO REMOTO, APLICADO A SARDINHA, SARDINELLA BRASILIENSIS]**
Nelson deJesusParada, Principal Investigator and Sydnea Maluf Feb. 1979 234 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10254; NASA-CR-158860; INPE-1423-TDL/03) Avail: NTIS HC A11/MF A01 CSCL 08A

**N79-31720*#** ECON, Inc., Princeton, N. J.
**STATUS OF SEASAT COMMERCIAL DEMONSTRATION PROGRAM**
Larrain Luckl and B. P. Miller, Principal Investigators Dec. 1978 86 p refs Workshop held at Pasadena, Calif., 31 Oct. - 1 Nov. 1978 Sponsored by NASA ERTS
(E79-10260; NASA-CR-158875; ECON-78-292) Avail: NTIS HC A05/MF A01 CSCL 17B

**N79-31737*#** ECON, Inc., Princeton, N. J.
**SEASAT-A ASVT: COMMERCIAL DEMONSTRATION EXPERIMENTS. RESULTS ANALYSIS METHODOLOGY FOR THE SEASAT-A CASE STUDIES**
28 Aug. 1979 62 p refs Revised
(Contract NASw-3047)
(NASA-CR-162162; DOC-79-292-2-Rev-2) Avail: NTIS HC A04/MF A01 CSCL 05B

The SEASAT-A commercial demonstration program ASVT is described. The program consists of a set of experiments involving the evaluation of a real time data distributions system, the SEASAT-A user data distribution system, that provides the capability for near real time dissemination of ocean conditions and weather data products from the U.S. Navy Fleet Numerical Weather Central to a selected set of commercial and industrial users and case studies, performed by commercial and industrial users, using the data gathered by SEASAT-A during its operational life. The impact of the SEASAT-A data on business operations is evaluated by the commercial and industrial users. The approach followed in the performance of the case studies, and the methodology used in the analysis and integration of the case study results to estimate the actual and potential economic benefits of improved ocean condition and weather forecast data are described. A.W.H.

**N79-32611*#** Lancaster Univ. (England).
**SATELLITE MONITORING OF SEA SURFACE POLLUTION Progress Report, period ending 31 Aug. 1979**
Gilbert Fielder and Duncan John Telfer, Principal Investigators 31 Aug. 1979 35 p refs Sponsored by NASA ERTS
(E79-10287; NASA-CR-162274; PR-2-13/P5) Avail: NTIS HC A03/MF A01 CSCL 13B

**N79-32615#** Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
**BASIC REMOTE SENSING INVESTIGATION FOR COASTAL RECONNAISSANCE**
D. Lyzenga, R. Shuchman, C. Davis, and G. Suits Jun. 1979 58 p refs Presented at the 13th Intern. Symp. on Remote Sensing of Environ., 23-27 Apr. 1979
(Contract N00014-78-C-0458)
(AD-A070770; ERIM-134400-7-T) Avail: NTIS HC A04/MF A01 CSCL 17/8

Contents: The use of Remote Sensing in the Determination of Beach Sand Parameters; Shallow-Water Reflectance Modeling with Applications to Remote Sensing of the Ocean Floor; and Evaluation of an Algorithm for Mapping Bottom Features Under a Variable Depth of Water. GRA

**N79-33525*#** Centre National d'Etudes Spatiales, Paris (France).
**SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE**
P. Y. Deschamps (Lille Univ., France), M. Crepon (Museum National d'Histoire Naturelle, France), J. M. Monget (Ecole National Superieure des Mines de Paris), and F. Verger, Principal Investigators (Ecole Normale Superieure, France) Aug. 1979 39 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10293; NASA-CR-162324) Avail: NTIS HC A03/MF A01 CSCL 08J

**N79-33779*#** Mississippi State Univ., State College. Dept. of Geology and Geography.
**BEACH EROSION CONTROL STUDY AT PASS CHRISTIAN**
31 Dec. 1978 173 p refs
(Grant NGL-25-001-054)
(NASA-CR-162349) Avail: NTIS HC A08/MF A01 CSCL 08C

The methods of measuring the existence of erosion and the effects of sand stabilization control systems are described. The mechanics of sand movement, the nature of sand erosion, and the use of satellite data to measure these factors and their surrogates are discussed using the locational and control aspects of aeolian and litoral erosion zones along the sand beach of the Mississippi coast. The aeolian erosion is highlighted due to the redeposition of the sand which causes high cleanup costs, property damage, and safety and health hazards. The areas of differential erosion and the patterns of beach sand movement are illustrated and the use of remote sensing methods to identify the areas of erosion are evaluated. A.W.H.

# 06

# HYDROLOGY AND WATER MANAGEMENT

**Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.**

**A79-44394** # **Soil water content estimation in fallow fields from airborne thermal scanner measurements.** J. Cihlar (Canada Centre for Remote Sensing, Ottawa, Canada), T. Sommerfeldt (Agriculture Canada, Lethbridge, Alberta, Canada), and B. Paterson (Alberta Agriculture, Irrigation Div., Lethbridge, Canada). *Canadian Journal of Remote Sensing,* vol. 5, May 1979, p. 18-32. 11 refs.

**A79-48446** **Use of geoencoded aerial photography as a regional data base for water resources and environmental planning studies.** J. D. Fellows (Maryland, University, College Park, Md.) and J. C. Stewart (Maryland-National Capital Park and Planning Commission, Silver Spring, Md.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 1-8. (ASP 79-101)

**A79-48447** * **The use of microwave approaches in hydrology.** T. J. Schmugge (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, Md.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 9-28. 29 refs.

Passive (radiometry) and active (radar) microwave approaches and their application to the study of the earth's hydrologic problem are examined and parameters including soil moisture content, snowpack properties, surface water area and the detection of precipitation overland are studied. Results show that these methods are capable of monitoring the moisture content in the surface layer of the soil in 5 cm thickness, detecting the presence of liquid water in snow and observing oil slicks. In addition, the methods make it possible to determine the water equivalent of snow packs and to delineate areas of rainfall over land. C.F.W.

**A79-48448** **Remote sensing of suspended sediments in Lake Chicot, Arkansas.** J. C. Ritchie and F. R. Schiebe (U.S. Department of Agriculture, Sedimentation Laboratory, Oxford, Miss.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 29-39. (ASP 79-104)

An eighteen month study on Lake Chicot has shown that reflected solar radiation can be used to estimate the concentration of suspended solids in the surface water. Wavelength between 700 and 900 nm give the best estimates of the concentration of solids. This study shows that it should be possible to estimate the concentration of suspended solids in the surface water of Lake Chicot using remote sensing technology. Thus, Landsat images, aerial photography, or a sensor mounted directly over the water surface transmitting data to satellites for relay could give a reservoir manager valuable data about suspended sediment concentration which would be useful in the decisionmaking process on how to route water to a reservoir. (Author)

**A79-48449** **Trophic classification of Tennessee Valley area reservoirs.** F. L. Scarpace (Wisconsin, University, Madison, Wis.), D. Malone, D. Meinert, and A. Voss (Tennessee Valley Authority, Chattanooga, Tenn.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 40-55. 20 refs. (ASP 79-105)

The study evaluates the application of Landsat multispectral scanner (MSS) imagery for assessing the trophic status of the major lakes and reservoirs in the Tennessee Valley. Landsat MSS data from two different dates were extracted from computer tapes using a semiautomated digital data handling and analysis system at the University of Wisconsin-Madison. These data were correlated with water quality data collected by the Environmental Protection Agency during the 1973 National Eutrophication Survey (NES) at 15 reservoirs in the Tennessee Valley. Significant correlations (larger than 0.85) between the MSS statistics and many trophic indicators were identified. Regression models were developed to predict from the MSS data individual indicators of trophic condition (Secchi disk depth, conductivity, and total phosphorus) as well as an overall trophic state index. To illustrate the spatial variations within the reservoirs, a table-look-up elliptical classification was used in conjunction with each reservoir's trophic state index to classify each reservoir on a pixel-by-pixel basis. (Author)

**A79-48450** * **A methodology for dam inventory and inspection with remotely sensed data.** J. P. Berger, W. R. Philipson, and T. Liang (Cornell University, Ithaca, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 56-67. 5 refs. Research supported by the U.S. Department of the Interior; Grant No. NGL-33-010-171. (ASP 79-106)

A methodology is presented to increase the efficiency and accuracy of dam inspection by incorporating remote sensing techniques into field-based monitoring programs. The methodology focuses on New York State and places emphasis on readily available remotely sensed data - aerial photographs and Landsat data. Aerial photographs are employed in establishing a state-wide data base, referenced on county highway and U.S. Geological Survey 1:24,000 scale, topographic maps. Data base updates are conducted by county or region, using aerial photographs or Landsat as a primary source of information. Field investigations are generally limited to high-hazard or special problem dams, or to dams which cannot be assessed adequately with aerial photographs. Although emphasis is placed on available data, parameters for acquiring new aircraft data for assessing dam condition are outlined. Large scale (1:10,000) vertical, stereoscopic, color-infrared photography, flown during the spring or fall, is recommended. (Author)

**A79-48456** * **A thermal scanning study of coastal upwelling in Lake Superior.** F. L. Scarpace, T. Green, III, and R. P. Madding (Wisconsin, University, Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 349-378. 10 refs. NASA-supported research; NSF Grant No. 33140. (ASP 79-147)

The use of a thermal scanner to monitor the time evolution of the thermal structure of the coastal waters in Lake Superior during an upwelling event is described. Mosaics of thermal imagery from ten different times are described. Qualitative descriptions of the imagery give insight into the upwelling event. Recommendations for future use of a thermal scanner to monitor an upwelling event are discussed. (Author)

**A79-48468** * **Developing in situ flood estimators using multi-date Landsat imagery.** J. N. McLeester and W. R. Philipson (Cornell University, Ithaca, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. (A79-48445 21-43) Falls Church, Va., American Society of Photogrammetry, 1979, p. 625-637. Grant No. NGL-33-010-171. (ASP 79-211)

Landsat satellite imagery is being used as the primary source of information on flooding in the Black River Basin of northern New York State. Landsat images (Band 7) depicting flood conditions during several flood seasons since 1973 were obtained for analysis. Visual interpretation of these images is providing the basis for quantitatively relating in situ measurements of river discharge with the total area and geographic locations of inundation. This, in turn, will provide real-time estimation of flood losses over the entire river basin. This practical and inexpensive approach can provide sufficiently reliable information, and is applicable in other similar river basins. (Author)

**A79-48469** **Digital Landsat processing to assess New York Bight acid dump.** R. M. Hord (Institute for Advanced Computation, Moffett Field, Calif.) and R. T. Macomber (Earth Satellite Corp., Washington, D.C.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 638-661. (ASP 79-212)

To show the benefits of remote sensing data acquisition applied to studies of the coastal marine ecosystem in the New York Bight area, and the benefits of remote sensing based information products which can be provided to area users, a demonstration of using remote sensor records for the study of circulation, dispersion, and related environmental characteristics is undertaken. A major objective was to determine the dye implant specifications necessary to create a streamer large enough and bright enough to be imaged by Landsat. The combination of various data sources contributed to a basic understanding of the interactions of the major New York Bight current components including the Hudson and Raritan River discharges, flood and ebb tidal currents, wind-driven currents, and the drift and dispersion rates of the acid dumps. The digital processing of the Landsat data succeeded in detecting the dye implant locations. S.D.

**A79-49347 * #** **Remote sensing of phytoplankton density and diversity in Narragansett Bay using an airborne fluorosensor.** F. H. Farmer, C. A. Brown, Jr., O. Jarrett, Jr., J. W. Campbell, and W. L. Staton (NASA, Langley Research Center, Hampton, Va.). *International Symposium for Remote Sensing of Environment, 13th, Ann Arbor, Mich., Apr. 23-27, 1979, Paper.* 14 p. 12 refs.

An aircraft-borne remote system is presented that utilizes narrow-band light from multiple dye lasers to excite selected algae photopigments and then measures the resultant flourescence emitted from chlorophyll a at 685 nm. Tests were conducted with both pure and mixed cultures of marine algae from a series of field tests taken from piers and bridges of Narragansett Bay, and a prototype remote fluorosensor was flown over the Bay during the 1978 winter-spring diatom bloom. Remote fluorescence obtained at hover points over sea-truth stations showed correlations with in situ fluorescence, total chlorophyll a, and cell count. It was concluded that the ratio of remote fluorescence to direct chlorophyll a concentration was less variable than expected, and the distribution of total chlorophyll a between two major photoplankton color groups showed three distinct areas, within the Bay, of green and golden-brown species. C.F.W.

**A79-53581 *** **Remote sensing of snow and ice.** A. Rango (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1262-1264, 1282-1288. 255 refs.

This paper reviews remote sensing of snow and ice, techniques for improved monitoring, and incorporation of the new data into forecasting and management systems. The snowcover interpretation of visible and infrared data from satellites, automated digital methods, radiative transfer modeling to calculate the solar reflectance of snow, and models using snowcover input data and elevation zones for calculating snowmelt are discussed. The use of visible and near infrared techniques for inferring snow properties, microwave monitoring of snowpack characteristics, use of Landsat images for collecting glacier data, monitoring of river ice with visible imagery from NOAA satellites, use of sequential imagery for tracking ice flow movement, and microwave studies of sea ice are described. Applications of snow and ice research to commercial use are examined, and it is concluded that a major problem to be solved is characterization of snow and ice in nature, since assigning of the correct properties to a real system to be modeled has been difficult. A.T.

**A79-53884 *** **Theory and experiment for passive microwave remote sensing of snowpacks.** J. A. Kong, R. Shin, L. Tsang (MIT, Cambridge, Mass.), and J. C. Shiue (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research,* vol. 84, Sept. 10, 1979, p. 5669-5673. 7 refs. Contracts No. NAS5-24139; No. F08635-78-C-0115.

Both the theory and experiment for the passive remote sensing of snow with microwave radiometers have been studied. The volume scattering effects of snow are accounted for by incorporating Mie scattering theory into a radiative transfer model. The theory is applied to the interpretation of experimental data obtained from various snow measurements. The spectral and angular dependences of the brightness temperatures are illustrated and show good agreement between the theory and experiment. Brightness temperatures as a function of snow depths are also interpreted and discussed. It is observed that as the snow depth increases, the brightness temperature increases when the subsurface is an aluminum plate due to the fact that the plate is cold and snow absorption induces a brightening effect and the brightness temperature decreases when the subsurface is soil due to the fact that snow scattering induces darkening effects. (Author)

**N79-28634*#** Environmental Research and Technology, Inc., Concord, Mass.

**INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Apr. - Jun. 1979**

James C. Barnes, Principal Investigator 6 Jul. 1979 5 p ERTS
(Contract NAS5-24316)
(E79-10213; NASA-CR-158685; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 08L

**N79-28794*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**A REGRESSION TECHNIQUE FOR EVALUATION AND QUANTIFICATION FOR WATER QUALITY PARAMETERS FROM REMOTE SENSING DATA**

Charles H. Whitlock and Chin Y. Kuo (Old Dominion Univ., Norfolk, Va.) May 1979 17 p refs Presented at 13th Intern. Symp. on Remote Sensing of the Environ., Ann Arbor, Mich., 23-27 Apr. 1979
(NASA-TM-80101) Avail: NTIS HC A02/MF A01 CSCL 13B

The objective of this paper is to define optical physics and/or environmental conditions under which the linear multiple-regression should be applicable. An investigation of the signal-response equations is conducted and the concept is tested by application to actual remote sensing data from a laboratory experiment performed under controlled conditions. Investigation of the signal-response equations shows that the exact solution for a number of optical physics conditions is of the same form as a linearized multiple-regression equation, even if nonlinear contributions from surface reflections, atmospheric constituents, or other water pollutants are included. Limitations on achieving this type of solution are defined. F.O.S.

**N79-28864*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INVESTIGATION OF EFFECTS OF BACKGROUND WATER ON UPWELLED REFLECTANCE SPECTRA AND TECHNIQUES FOR ANALYSIS OF DILUTE PRIMARY-TREATED SEWAGE SLUDGE**
Charles H. Whitlock, J. W. Usry, William G. Witte, Franklin H. Farmer, and E. A. Gurganus Aug. 1979 36 p refs
(NASA-TP-1446; L-12694) Avail: NTIS HC A03/MF A01 CSCL 08J

In an effort to improve understanding of the effects of variations in background water on reflectance spectra, laboratory tests were conducted with various concentrations of sewage sludge diluted with several types of background water. The results from these tests indicate that reflectance spectra for sewage-sludge mixtures are dependent upon the reflectance of the background water. Both the ratio of sewage-sludge reflectance to background-water reflectance and the ratio of the difference in reflectance to background-water reflectance show spectral variations for different turbid background waters. The difference in reflectance in the only parameter considered. Author

**N79-29567** Delaware Univ., Newark.
**SPECTRAL REFLECTANCE OF TIDAL WETLAND PLANT CANOPIES AND IMPLICATIONS FOR REMOTE SENSING Ph.D. Thesis**
David Scott Bartlett 1979 253 p
Avail: Univ. Microfilms Order No. 7918797

In order to assess the potential for extending quantitative remote sensing capabilities into collection of data on tidal wetlands an investigation was carried out in Delaware with particular emphasis on application of Landsat/MSS data. Spectral contrast between S. alterniflora and Salt Hay (a mixed category containing S. patens and D. spicata) depended primarily on species-specific differences in the amount and growth form of vegetation. Contrast was seasonally variable and was controlled by a variety of factors related to canopy composition and structure. It was determined that potential exists for use of spectral data in estimating mean green and total biomass for areas of S. alterniflora using either hand-held instruments in the field or Landsat/MSS data. Dissert. Abstr.

**N79-30594*#** Great Lakes Basin Commission, Ann Arbor, Mich.
**STATE-REGIONAL FUTURE GREAT LAKES REGION: THE 1975 NATIONAL WATER ASSESSMENT**
Jul. 1976 179 p refs Sponsored by NASA ERTS
(E79-10233; NASA-CR-158797) Avail: NTIS HC A09/MF A01 CSCL 08H

**N79-30607*#** National Oceanic and Atmospheric Administration, Washington, D. C.
**APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report**
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, Jr., and Michael Matson 17 Jul. 1979 11 p ERTS
(NASA Order S-40229-B)
(E79-10248; NASA-CR-158794) Avail: NTIS HC A02/MF A01 CSCL 08M

**N79-30608#** RAND Corp., Santa Monica, Calif.
**ADJUSTMENT AND VERIFICATION OF THE RAND-DELTA 2 MODEL**
A. Langerak (Delft Hydraulics Lab.), M. A. M. Deras (Rijkswaterstaat), and J. J. Leendertse Sep. 1978 24 p refs Presented at the 16th Intern. Conf. on Coastal Eng., Hamburg, 1978
(P-6247) Avail: NTIS HC A02/MF A01

In the mid-1950s the Netherland government embarked on a massive dike and dam construction program, called the Delta Plan. Its purpose was to enhance protection from floods caused by the North Sea in the estuaries of the Rhine, Meuse and Scheldt. In support of engineering and environmental studies related to the construction and operation of a storm barrier (revised plan), a large numerical model was developed which covers the Eastern and Western Scheldt and the adjacent offshore area. The section of the North Sea which is included in the model is about 120 km long and 30 kn wide, running from Blankengerghe in Belgium to Scheveningen in the Netherlands. Topics discussed include: (1) model formulation; (2) computation approximation; (3) modeling system; (4) aspects of tidal wave propagation in the model area; (5) submodels; and (6) model adjustment and verification. G.Y.

**N79-30611*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A COMPARATIVE STUDY OF MICROWAVE RADIOMETER OBSERVATIONS OVER SNOWFIELDS WITH RADIATIVE TRANSFER MODEL CALCULATIONS**
A. T. C. Chang and J. C. Shiue May 1979 31 p refs Submitted for publication
(NASA-TM-80267) Avail: NTIS HC A03/MF A01 CSCL 08L

Truck mounted microwave instrumentation was used to study the microwave emission characteristics of the Colorado Rocky Mountain snowpack in the vicinity of Fraser, Colorado during the winter of 1978. The spectral signatures of 5.0, 10.7, 18, and 37 GHz radiometers with dual polarization were used to measure the snowpack density and temperature profiles, rain profile, and free water content. These data were compared with calculated results based on microscopic scattering models for dry, surface melting, and very wet snowpacks. K.L.

**N79-30617#** Centre National d'Etudes Spatiales, Toulouse (France).
**ESTIMATION OF IRRIGATED SURFACES IN THE SEINE-NORMANDY BASIN [ESTIMATION DES SURFACES IRRIGUEES DU BASSIN SEINE-NORMANDIE]**
G. Saint, G. Bediot (Agence Financiere de Bassin Seine-Normandie, Paris), and D. Clergeot (Univ. of Paris 1) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 41-48 In FRENCH

Avail: NTIS HC A99/MF A01

A feasibility study for the estimation of irrigated surfaces in the Seine-Normandy basin was made from numerically treated LANDSAT satellite images. Results show that precision in measuring irrigated surfaces is better than that demanded by the regional agency. Nevertheless, an extension to the whole basin was limited by image availability. Author (ESA)

**N79-30618#** Waterloo Univ. (Ontario).
**APPLICATION OF REMOTE SENSING TO THE ASSESSMENT OF WATER RESOURCES**
S. I. Solomon and W. Klohn *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 49-61 refs Sponsored in part by WMO

Avail: NTIS HC A99/MF A01

A state of the art review of the applications of spatial remote sensing techniques for the assessment of the variables affecting the water cycle is presented. Emphasis is on the hydrological aspects and particularly the problems of flooding, snow, and ice. The application of remote sensing techniques to assess the geomorphical characteristics of river basins is also dealt with. A brief discussion of the future development needs of hydrologists and water resources managers is included. Author (ESA)

**N79-30619#** Ecole Superieure de Genie Civil, Bucharest (Rumania).
**RESULTS OBTAINED IN THE EVALUATION OF THE LOWER DANUBE BASIN AND DANUBE DELTA BY TELEDETECTION. TECHNOLOGY ADAPTED TO CURRENTLY AVAIL-**

**ABLE EQUIPMENT [RESULTATS OBTENUS DAN L'INVENTAIRE DES RESSOURCES DU BASSIN INFERIEUR DU DANUBE ET DANS LE DELTA DU DANUBE PAR TELEDETECTION; TECHNOLOGIES ADAPTEES AU CAS DES MOYENS RESTREINTS]**
N. Oprescu and E. Mandescu (Comm. Roumaine de l'Activite Spatiale) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 63-76 refs In FRENCH

Avail: NTIS HC A99/MF A01

A teledetection technique limited to the use of available equipment is presented. A mixed analog-digital data processing system was used, working with successive approximations and starting with a digital treatment. Data from the LANDSAT satellite were employed in monitoring specific variables in the domains of agriculture, hydrology, pollution, and geology. It is concluded that multispectral data processing must be digital and that teledetection will be helpful in predicting crop yield, pollution, water reserves, flooding, and other important environmental parameters. Conditions necessary to perfect the methods are discussed. Author (ESA)

**N79-30620#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany).
**MASS APPEARANCE OF BLUE GREEN ALGAE IN THE BALTIC SEA: EVALUATION OF MULTISPECTRAL LANDSAT SCENES BY IMAGE PROCESSING**
K. A. Ulbricht, D. Schmidt (Ger. Hydrographic Inst.), and U. Horstmann (Kiel Univ.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 77-89 refs
Avail: NTIS HC A99/MF A01

Accumulation of blue green algae, Nodularia spumigena and Alphanisomenon flos aquae, was detected from digital image processing of LANDSAT scenes of the Baltic sea. White traces appear in some spectral regions (MSS 4 and MSS 5), which are shown to be due to algae. Blue green algae participate in the fixing of nitrogen from the air and its abnormal growth is probably related to an increase in phosphate concentrations due to sewage discharge having a high phosphorus content in the regions near the sea coast. It is also concluded that space detected traces are to be complimented by in situ measurements in order to get reliable quantitative information. Author (ESA)

**N79-30623#** Operation Pilote Interministerielle de Teledetection, Paris (France).
**TELEDETECTION AND WATER RESOURCES [TELEDETECTION ET RESSOURCES EN EAU]**
Claudine Valerio and Yves Vuillaume *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 97-102 refs In FRENCH

Avail: NTIS HC A99/MF A01

The role of interministerial collaboration in the Teledetection Interministerial Pilot Operation is pointed out and the main phases of the program are described. Two examples involving water pollution are given, covering the subjects of aircraft monitoring with teledetection of hydrocarbon pollution on the sea and simulation of sea water pollution by Rhodamine diffusion in the Propiano bay. Author (ESA)

**N79-30683#** Army Construction Engineering Research Lab., Champaign, Ill.
**BASIC ANALYTICAL MODEL FOR ENVIRONMENTAL IMPACT ASSESSMENT OF SURFACE WATER RESOURCES Final Report**
Robert E. Riggins, V. Kothandaraman, and Bruce C. Goettel May 1979 41 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A069977; CERL-TR-N-64) Avail: NTIS HC A03/MF A01 CSCL 08/8

This report discusses and provides user instructions for a computerized water quality model that will help satisfy the Army environmental planner's need for quantitative information on dissolved oxygen resources in a stream caused by new Army projects or activities. The information provided by output from this model will be useful for providing data for impacts on the dissolved oxygen content of a stream for a single-reach, single-point-source pollutant inflow situation with steady-flow conditions. Three subprograms within the model are used to calculate the impact of carbonaceous and nitrogenous waste discharges on the oxygen resources in a receiving water body, the ultimate biological oxygen demand and deoxygenation coefficients for both carbonaceous and nitrogenous waste discharges, and annual variations in temperature of a water body. Author

**N79-30704#** National Environmental Satellite Service, Washington, D. C.
**SATELLITES AS AN AID TO WATER RESOURCE MANAGERS**
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg Apr. 1979 25 p refs Presented at Convention and Exposition of Am. Soc. of Civil Engr., Boston, 2-6 Apr. 1979
(PB-296048/2; NOAA-79040901; ASCE/Preprint-3486) Avail: NTIS HC A02/MF A01 CSCL 04B

Examples of satellite data applications to water resource problems are presented to draw attention to a current source of data often overlooked by water managers. Although spatial and temporal constraints exist, satellite data can contribute useful information toward solutions of mesoscale and macroscale water resource problems; e.g., areal snow cover determinations, river ice, flood extent, and short-term precipitation estimates. GRA

**N79-31713*#** South Dakota State Univ., Brookings. Remote Sensing Inst.
**HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUND WATER POLLUTION Interim Report, Apr. - Jun. 1979**
Donald G. Moore, Principal Investigator and J. Heilman Jun. 1979 3 p ERTS
(Contract NAS5-24206)
(E79-10253; NASA-CR-158859; SDSU-RSI-79-13) Avail: NTIS HC A02/MF A01 CSCL 08H

**N79-31724*#** Pakistan Water and Power Development Authority, Lahore.
**WATER RESOURCES INVESTIGATION IN PAKISTAN WITH THE HELP OF ERTS IMAGERY. SNOW SURVEYS, 1975-1976**
Asrar Ahmad Qureshy and Mohammed Umar, Principal Investigators Mar. 1978 92 p Sponsored by NASA ERTS
(E79-10265; NASA-CR-157455) Avail: NTIS HC A05/MF A01 CSCL 08H

**N79-31728*#** Texas A&M Univ., College Station. Remote Sensing Center.
**MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Jun. 1978 - 1 Jun. 1979**
Bruce J. Blanchard, Principal Investigator 1 Jun. 1979 15 p ERTS
(Grant NsG-5134)
(E79-10270; NASA-CR-162092; RSC-3458-3) Avail: NTIS HC A02/MF A01 CSCL 08M

**N79-31729*#** Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
**HCMM HEAT CAPACITY MAPPING MISSION Quarterly Progress Report, 1 May - 31 Jul. 1979**
Ray D. Jackson, Principal Investigator 31 Jul. 1979 1 p
ERTS
(NASA Order S-40255-B)
(E79-10272; NASA-CR-162101) Avail: NTIS
HC A02/MF A01 CSCL 05B

**N79-31732*#** Bern Univ. (Switzerland). Dept. of Geography.
**TOPOCLIMATOLOGICAL AND SNOWHYDROLOGICAL SURVEY OF SWITZERLAND Progress Report**
Matthias Winiger, Principal Investigator Aug. 1979 5 p
Sponsored by NASA ERTS
(E79-10275; NASA-CR-162096; PR-1) Avail: NTIS
HC A02/MF A01 CSCL 08L

The author has identified the following significant results. The chosen time of overflight of HCMM seems to be ideal for the study of basic climatological events. Nocturnal temperature inversion zones are easily detectable and their dependency on the relief is clearly seen. Especially the alpine valleys show a very differentiated pattern of cold lakes, separated by warmer zones as a consequence of rock and forrest barriers or changes in the valley profile. Wet areas are usually colder than dry parts under comparable topographic conditions. Even very small topographic obstacles are able to block up the flow of cold air masses (or ground water flow). Urban areas are clearly detectable. Differences to the surface temperatures of surrounding rural land are much more significant during day-time (mainly during the summer months). Fog layers are clearly defined in the visible channel (day-time), but much more difficult to identify in the IR (mainly during the night). There is not a fundamental difference to NOAA-analysis of cloud systems. The most important advantage is the better detectability of convective cloud systems (small cumulus clouds).

**N79-32603*#** National Environmental Satellite Service, Washington, D. C.
**SELECTED HYDROLOGIC APPLICATIONS OF LANDSAT-2 DATA: AN EVALUATION Final Report**
Donald R. Wiesnet, David F. McGinnis, Jr., and Michael Matson, Principal Investigators 1978 205 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-3991)
(E79-10264; NASA-CR-162098) Avail: NTIS
HC A10/MF A01 CSCL 08H

The author has identified the following significant results. Estimates of soil moisture were obtained from visible, near-IR gamma ray and microwave data. Attempts using GOES thermal-IR were unsuccessful due to resolutions (8 km). Microwaves were the most effective at soil moisture estimates, with and without vegetative cover. Gamma rays provided only one value for the test site, produced by many data points obtained from overlapping 150 meter diameter circles. Even though the resulting averaged value was near the averaged field moisture value, this method suffers from atmospheric contaminants, the need to fly at low altitudes, and the necessity of prior calibration of a given site. Visible and near-IR relationships are present for bare fields but appear to be limited to soil moisture levels between 5 and 20%. The densely vegetated alfalfa fields correlated with near-IR reflectance only; soil moisture values from wheat fields showed no relation to either or near-IR MSS data.

**N79-32609*#** Telespazio, S.p.A., Rome (Italy).
**EVALUATION OF WATER TRANSPARENCY MEASUREMENTS DERIVED FROM LANDSAT DATA AND GROUND TRUTH: AN EXAMPLE FROM THE TIBER RIVER MOUTH**
Angelo Zandonella, Principal Investigator 1979 18 p refs
Presented at 4th UN Intern. Training Course on the Application of Remote Sensing Techniques to Fisheries in Cooperation with FAO and Italian Government, Rome, May 1979 Sponsored by NASA ERTS
(E79-10285; NASA-CR-162271) Avail: NTIS
HC A02/MF A01 CSCL 08H

**N79-33524*#** Louisiana State Univ., Baton Rouge. Div. of Engineering Research.
**INTERPRETATION OF REMOTE SENSING DATA IN THE BAYOU LAFOURCHE DELTA OF SOUTH LOUISIANA Final Report, 1 Jun. 1972 - 15 Aug. 1979**
C. A. Whitehurst, Principal Investigator Sep. 1979 34 p refs
ERTS
(Grant NGL-19-001-105)
(E79-10291; NASA-CR-162285) Avail: NTIS
HC A03/MF A01 CSCL 05B

**N79-33527*#** Environmental Research and Technology, Inc., Concord, Mass.
**INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Jul. - 30 Sep. 1979**
James C. Barnes, Principal Investigator 10 Oct. 1979 5 p
ERTS
(Contract NAS5-24316)
(E79-10295; NASA-CR-162326; QPR-8) Avail: NTIS
HC A02/MF A01 CSCL 08H

**N79-33534#** Army Cold Regions Research and Engineering Lab., Hanover, N. H.
**SNOWPACK OPTICAL PROPERTIES IN THE INFRARED**
Roger H. Berger May 1979 16 p refs
(DA Proj. 4A7-62730-AT-42)
(AD-A071004; CRREL-79-11) Avail: NTIS HC A02/MF A01
CSCL 08/12

A theory of the optical properties of snow in the 2-20 microns region of the infrared has been developed. Using this theory it is possible to predict the absorption and scattering coefficients and the emissivity of snow, as a function of the snow parameters of grain size and density, for densities between 0.17 and 0.4 g/cu. cm. The absorption and scattering coefficients are linearly related to the density and inversely related to the average grain size. The emissivity is independent of grain size and exhibits only a weak dependence upon density. GRA

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# 07
# DATA PROCESSING AND DISTRIBUTION SYSTEMS

**Includes film processing, computer technology, satellite and aircraft hardware, and imagery.**

**A79-44126** **Aerial and spaceborne observations of the earth: Computer processing of video data (Aerokosmicheskie issledovaniia zemli: Obrabotka videoinformatsii na EVM).** Edited by V. G. Zolotukhin. Moscow, Izdatel'stvo Nauka, 1978. 246 p. In Russian.

The methods and algorithms used to process video data from aerospace platforms are discussed. Techniques used in coordinate gridding and geometric transformation of imagery from airplane- and satellite-based scanners are described, together with the classification of multispectral measurements. Special attention is given to methods of thematic analysis for the evaluation of earth resources. C.K.D.

**A79-44127** # **The problem of processing and utilizing spacecraft observations in studies of the earth (O probleme obrabotki i ispol'zovaniia kosmicheskoi informatsii v issledovaniiakh zemli).** Ia. L. Ziman and G. A. Avanesov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 5-11. In Russian.

The specific characteristics of space-based observations are outlined, and difficulties encountered in their processing and interpretation are examined. The basic steps in processing data from spacecraft scanners are described. C.K.D.

**A79-44131** # **Compression of multispectral video data (O szhatii mnogozonal'noi videoinformatsii).** Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 36-55. 7 refs. In Russian.

The characteristics of multispectral video data are examined together with the most adequate performance criterion for the description of these data by different problems in thematic processing. General methods of discrete description of an uninterrupted series of measurements carried out at a constant rate are presented, and a broad class of adaptive procedures for fixed-rate encoding is discussed. The application of these methods to compression of remote sensing data is described, and a preliminary assessment of the efficacy of these methods for compression of multispectral video data is given. C.K.D.

**A79-44135** # **The discrimination of natural features in multispectral sensing (Raspoznavanie prirodnykh obrazovanii pri mnogospektral'nom zondirovanii).** V. A. Krasikov and Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 87-107. In Russian.

Different formulations of the problem of discrimination in processing multispectral observations are examined. A random vector of measurement model is developed, and the selection of discrimination regions on the basis of 'training' samples is discussed. Interfering parameters are classified, and their effect on the accuracy of discrimination is considered. C.K.D.

**A79-44136** # **Discrimination of natural targets according to their spectral features (Raspoznavanie prirodnyk ob'ektov po spektral'nym priznakam).** I. G. Rozanov and A. P. Tishchenko. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 107-112. In Russian.

A method of discriminating natural targets on the basis of their spectral features is presented. The approach is based on the utilization of a priori information on the spectral characteristics of the desired class of targets and application of multivariable statistical, analysis techniques. Some results obtained by application of this method in the discrimination of forest tracts from satellite imagery are discussed. C.K.D.

**A79-44137** # **Cluster analysis methods for thematic processing of multizone video data (Metody klasternogo analiza v zadachakh tematicheskoi obrabotki mnogozonal'noi videoinformatsii).** V. A. Krasikov, M. V. Khatuntseva, and Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 112-126. 5 refs. In Russian.

The fundamental principles of cluster analysis are discussed, and the different types of cluster procedures are examined. Results obtained with several cluster analysis algorithms used in the classification of measurements from 4- and 6-zone scanners are described. C.K.D.

**A79-44144** # **Parametric methods for the identification of earth resources from multispectral data (Parametricheskie metody raspoznavaniia prirodnykh obrazovanii po materialam mnogozonal'nykh s'emok).** V. A. Krasikov, M. V. Khatuntseva, and Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 167-176. In Russian.

**A79-44149** # **Use of multispectral photography for studying the dynamics of vegetation (Primenenie mnogozonal'nogo fotografirovaniia dlia izucheniia dinamiki rastitel'nykh ob'ektov).** V. A. Kottsov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 207-212. In Russian.

**A79-44397** # **Geometric correction, registration, and resampling of Landsat imagery.** S. Shlien (Canada Centre for Remote Sensing, Ottawa, Canada). *(Canadian Remote Sensing Society, Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21, 1977.) Canadian Journal of Remote Sensing,* vol. 5, May 1979, p. 74-89. 29 refs.

The geometric distortions introduced by the Landsat imaging system are well known. However, the satellite does not provide attitude information with sufficient accuracy to determine the geographical position of each picture element or pixel. Thus, to map the data onto the desired space it is necessary to model a geometric transformation from a set of ground control points. Transformation of a Landsat image to a UTM co-ordinate grid to 50 meters accuracy (rms) under optimum conditions had been demonstrated. The main factor limiting the ultimate accuracy of the corrected image is the precision to which ground control points on the UTM maps can be mapped to pixels in the Landsat image. Digital correlation methods have been used successfully in image-to-image registration to improve the accuracy by 25%, but for map registration, this requires accurately located ground control photographic chips. Various resampling techniques including Lagrange polynomials are described. The errors introduced by these resampling methods are investigated both theoretically and experimentally. (Author)

**A79-45125** **Photointerpretation and multispectral classification for land use mapping (Luftbildinterpretation und multispektrale Klassifizierung zur Gewinnung von Landnutzungsdaten).** F. Quiel (Karlsruhe, Universität, Karlsruhe, West Germany). *Bildmes-*

*sung und Luftbildwesen,* vol. 47, July 1, 1979, p. 107-117. 5 refs. In German.

The interpretation of aerial photographs and computer aided classification of multispectral scanner data are compared for a land use inventoy. Problems and necessary working and computer time are demonstrated with the results from three test areas near Freiburg, West Germany. A cost estimation for an inventory of Baden-Württemberg indicates that a computer aided classification of Landsat data would be the most favorable solution despite some disadvantages such as somewhat limited precision. M.E.P.

**A79-47555 Planimetric restitution of Landsat imagery using the Zeiss stereotop.** E. Clerici and I. A. Harley (Queensland, University, Brisbane, Australia). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1123-1127. 10 refs.

A method of plotting planimetric detail using a Zeiss Stereotop is described. The method is based on a general affine transformation which has been shown to give accuracies of the same order of magnitude as the normal element of Landsat. Attention is given to practical implementation and restitution in three steps, inner-, relative-, and absolute orientation. Test results are given and it is concluded that because of the method's simplicity and the wide availability of the Zeiss Stereoscope, it should be particularly attractive to earth scientists. M.E.P.

**A79-48445 American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volumes 1 & 2.** Falls Church, Va., American Society of Photogrammetry, 1979. Vol. 1, 410 p.; vol. 2, 413 p. Price of two volumes, members, $7.50; nonmembers, $12.50.

The proceedings include such topics as the use of geoencoded aerial photography as a regional data base for water resources and environmental planning studies, a methodology for dam inventory and inspection with remotely sensed data, the potential for near ultraviolet spectral data to delineate geological materials, and map characteristics of Landsat mosaics. Remote sensing of suspended sediments in Lake Chicot, Arkansas, trophic classification of Tennessee Valley area reservoirs, and a thermal scanning study of coastal upwelling in Lake Superior are considered. Attention is given to a perceptually-based texture feature extractor for similarity measurements of imagery data and determination of lens falloff through digital analysis of photographic imagery. V.T.

**A79-48453 * Map characteristics of Landsat mosaics.** A. L. Zobrist and N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 260-273. 13 refs. Contract No. NAS7-100. (ASP 79-131)

Map characteristics of the Landsat mosaics developed at JPL are considered. Procedures for digital mosaicking of Landsat frames to standard map projections were used to mosaic at full resolution ten scenes over the California desert region and twenty-one scenes over Arizona. The procedures are analyzed for horizontal positioning error (global and local) and the potential for classification error associated with the adjustment of brightness of Z values between frames; the use of this technology for the mapping of extensive features is discussed. Mosaicking facilities, techniques, mapping accuracy, and thematic mapping characteristics are described. A comparative analysis of Landsat mosaicking technology developed at Goddard Space Flight Center, IBM Gaithersburg, and USGS Flagstaff is made, and suggestions are given for algorithm development to improve systems capacity and ability to handle a variety of cases. A.T.

**A79-48455 Principal components analysis and canonical analysis in remote sensing.** S. K. Jenson and F. A. Waltz (Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S. Dak.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 337-348. 5 refs. U.S. Geological Survey Contract No. 14-08-0001-16439. (ASP 79-143)

During 1977, principal components analysis and canonical analysis programs were implemented and tested at the EROS Data Center. The present paper gives mathematical definitions of both procedures, describes the effects the procedures have on imaged data, and suggests circumstances under which the techniques can be most effectively applied to analysis of aircraft and satellite data. B.J.

**A79-48466 Ground settlement monitoring by digital photogrammetry.** J. K. Crossfield (Arkansas, University, Fayetteville, Ark.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 600-606. 5 refs. (ASP 79-207)

A semi-automated digital photogrammetric process is described that facilitates ground settlement or subsidence monitoring. Relatively oriented stereomodels from a series of overlapping aerial photographs are adjusted to a common coordinate system by manipulation of model and state plane coordinates of imaged control points. Points chosen for settlement study in an initial stereomodel are also converted into the common coordinate system. These points are quite precisely located, sampled and adjusted in later date stereomodels. Elevation comparisons are made for sampled points. Application to ground subsidence monitoring problems in mining and construction activities show promise. The stereoplotter, digital computer, and human interactions necessary to accomplish ground settlement monitoring by digital photogrammetry are outlined in detail. (Author)

**A79-50214 The problem of resolution in the Landsat imagery.** R. J. Kalush, Jr. (Michigan State University, East Lansing, Mich.). *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 38-48.

The paper surveys some sources of error which occur in Landsat imagery. Attention is given to geometrical error including deviation from vertical. It is shown that the dynamic root-mean-squared error of the satellite from vertical is plus or minus 0.7 degrees which means 11.3 km at ground level. Other error sources discussed included nonperiodic variations in the scanning mirror, the oblateness of the earth and path distortion. Spectral error is also covered. Finally, the operating and design characteristics of the multispectral scanner are described. M.E.P.

**A79-50220 * Landsat-D thematic mapper simulation in an urban area using aircraft multispectral scanner data.** J. Clark (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly,* vol. 1, Apr. 1979, p. 17-32. Contract No. NAS7-100.

A simulation of imagery from the Landsat-D thematic mapper was conducted in order to determine its usefulness for urban land-use classification. Aircraft 24-channel multispectral scanner imagery of the Los Angeles area at 7.5-m resolution was processed digitally by means of matrix averaging and image smoothing techniques to simulate the 30-m resolution of the thematic mapper. Mean and standard deviation statistics of training sites for resolutions of 7.5, 15, 30 and 60 m were used to generate final classification maps. Plots of relative standard deviation showed that for larger training sites, as the resolution decreased, the distribution range of density values also decreased, while plots of relative classification accuracies showed that as resolution decreased, classification accuracies for three levels of standard deviation increased. A point of diminishing returns was indicated, however, confirming the utility of the resolution intended for Landsat-D. A.L.W.

**A79-50223** **Thermal data from Landsat III.** R. Lougeay (New York, State University Geneseo, N.Y.). *Remote Sensing Quarterly*, vol. 1, July 1979, p. 15-17. 6 refs.

The paper discusses the capabilities of the new experimental thermal imaging system aboard Landsat III launched on March 5, 1978. The thermal imaging system consisted of a fifth channel on the multispectral scanner, with a spectral sensitivity between 10,400 and 12,600 nm. Data acquired with this system provided imagery of terrestrial emittance which can be compared with patterns of reflected solar energy displayed in visible and near-visible-infrared spectral bands of Landsat multispectral scanners. Unfortunately, this thermal imaging system has not provided data of as high quality as initially expected, due to a series of system malfunctions. Both thermal and spatial resolution have been affected. S.D.

**A79-50330** **The application of reflected infrared color film to the study of environmental problems.** R. K. Holz (Texas, University, Austin, Tex.). In: Learning to use our environment; Proceedings of the Twenty-fifth Annual Technical Meeting, Seattle, Wash., April 30-May 2, 1979. Mount Prospect, Ill., Institute of Environmental Sciences, 1979, p. 14-18. 14 refs.

The technique of color infrared photography in the near, or reflected, infrared range is explained and its several applications to the remote sensing of environmental problems are presented. The development of infrared photography is traced from the discovery of infrared radiation by Herschel in 1800, considering the development of photographic media from colloidion emulsions to present-day cyanine dyes. The properties of three-layer color infrared, or false-color, film are examined, and the problems of the instability of infrared dyes and the color balance of color infrared photography are considered. Finally, applications of color infrared photography to the study of the health of farm crops, forests and grazing lands, the estimation of crop yields and the determination of land/water interfaces, water quality and flood plains are discussed. A.L.W.

**A79-52690 *** **Map-guided interpretation of remotely-sensed imagery.** J. M. Tenenbaum, H. G. Barrow, R. C. Bolles, M. A. Fischler, and H. C. Wolf (SRI International, Menlo Park, Calif.). In: Conference on Pattern Recognition and Image Processing, Chicago, Ill., August 6-8, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 610-617. 9 refs. Contract No. NASw-2865; Grant No. DAAG29-76-C-0057.

A map-guided approach to interpretation of remotely sensed imagery is described, with emphasis on applications involving continuous monitoring of predetermined ground sites. Geometric correspondence between a sensed image and a symbolic reference map is established in an initial stage of processing by adjusting parameters of a sensor model so that image features predicted from the map optimally match corresponding features extracted from the sensed image. Information in the map is then used to constrain where to look in an image and what to look for. With such constraints, previously intractable remote sensing tasks can become feasible, even easy, to automate. Four illustrative examples are given, involving the monitoring of reservoirs, roads, railroad yards, and harbors. (Author)

**A79-53374 *** **Improvement of selected satellite applications through the use of microwave data.** D. W. Mooneyhan (NASA, National Space Technology Laboratories, Bay Saint Louis, Miss.). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-244.* 22 p. 6 refs.

This paper describes an analysis of a data set in which satellite acquired microwave data (Seasat Synthetic Aperture Radar) have been registered with Landsat Multispectral Scanner data and the combined data processed using conventional multichannel spectral pattern recognition programs. Results of this analysis indicate that the combined data set offers improvement in surface classification that is significant to certain applications. A brief description of the registration procedure is given. The improvement in results rendered to selected resource management applications is discussed. The presented results are preliminary due to the short time that the satellite microwave data have been available; however, a more comprehensive analysis is in progress and will be completed during the coming year. (Author)

**A79-53377** **Processing and using SAR data.** P. Murino, L. G. Napolitano (Napoli, Università, Naples, Italy), and B. Apolloni (Calabria, Università, Cosenza, Italy). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-252.* 13 p. 32 refs.

The paper presents and discusses some possible methods of processing synthetic aperture radar (SAR). Topics discussed include: the SAR signal, radar backscatter, and filtering. Particular attention is given to the various processing algorithms in order to stress their influence on the quality of the reconstructed image. Finally, digital processing is discussed in detail since recent advances in digital technology have expanded the flexibility of SAR imagery processing techniques. M.E.P.

**A79-53382** **Region extraction for thematic analysis of remote sensed images.** B. Apolloni (Calabria, Università, Cosenza, Italy) and P. Murino (Napoli, Università, Naples, Italy). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-260.* 9 p. 11 refs.

A region extraction method proposed to construct a segmentation procedure and the performance of the corresponding algorithm used for the analysis of remotely sensed images is presented. The method is aimed to analyze the relevant parameters of the region model, its adaptability to real images, and its filtering action especially at the edges of the regions. The image is partitioned into topographical regions on the basis of a special region model, and then the regions are classified by per-field methods using the most relevant features. The corresponding segmentation algorithm results have small sensitivity to noise and to small variations of the mean values of the features in each region. A trade-off between enhancement and smoothness of the image can be made by proper tuning of parameters, concluding that the numerical implementation of the algorithm provides a sequential procedure of limited computational cost suitable for a large range of images. A.T.

**A79-53529 * #** **Information adaptive system of NEEDS.** W. M. Howle, Jr. and W. L. Kelly (NASA, Langley Research Center, Flight Electronics Div., Hampton, Va.). In: Remote sensing of earth from space: Role of 'smart sensors'; Proceedings of the Conference, Hampton, Va., November 14-16, 1978. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 213-220. 5 refs.

The NASA End-to-End Data System (NEEDS) program was initiated by NASA to improve significantly the state of the art in acquisition, processing, and distribution of space acquired data for the mid-1980s and beyond. The information adaptive system (IAS) is a program element under NEEDS Phase II which addresses sensor specific processing on board the spacecraft. The IAS program is a logical first step toward smart sensors, and IAS developments - particularly the system components and key technology improvements - are applicable to future smart efforts. The paper describes the design goals and functional elements of the IAS. In addition, the schedule for IAS development and demonstration is discussed. S.D.

**A79-53530 #** **End-to-end design concept.** P. A. Castruccio (Ecosystems International, Inc., Gambrills, Md.). In: Remote sensing of earth from space: Role of 'smart sensors'; Proceedings of the Conference, Hampton, Va., November 14-16, 1978. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 221-230. (AIAA 78-1738)

A significant fraction of NASA's space systems are designed to obtain and supply information. A meaningful analytical concept is to look at these systems as end-to-end information systems in which nature generates data. End-to-end data systems analysis has two valuable aspects: (1) in the system design phase, it sets forth the performance requirements to guide the subsequent tasks of the hardware designers; and (2) in the system verification phase, it provides the system's quality control or performance assurance function as to whether the system provides the results needed by the marketplace. Experimental and theoretical findings for Landsat crop classification are discussed. Optimal discrimination is achievable by means of several optimally positioned temporal 'cuts'. If the timings of observation are chosen properly, it is not necessary to observe an entire Landsat scene. S.D.

**A79-53942** **Landscape drawing from Landsat MSS data.** S. Tanaka and Y. Suga (Remote Sensing Technology Center of Japan, Tokyo, Japan). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Oct. 1979, p. 1345-1351. 7 refs.

A method to produce a landscape drawing from Landsat MSS data and the evaluation of the landscape drawing, along with an example, are addressed. Landscape drawing from Landsat MSS data is mathematically performed by using the central projection method. Particular attention was given to comparing the landscape drawing performed by such a method with the same landscape as viewed from the ground. To clarify this point, a landscape drawing of Mt. Fuji, one of the typical mountains in Japan, was produced and compared with pictures and photographs of it. The result of the work shows that the landscape drawing from Landsat MSS data is better than one might have expected. (Author)

**N79-28642*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**ACCEPTANCE TEST SPECIFICATIONS OF THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)**

J. M. Everette, Principal Investigator Mar. 1979 46 p refs EREP
(Contract NAS9-15800)
(E79-10228; NASA-CR-160246; LEC-12900; JSC-14635)
Avail: NTIS HC A03/MF A01 CSCL 05B

**N79-29570#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

**STATISTICAL ANALYSES OF TERRAIN DATA Final Report**

Anthony J. Larocca and J. Robert Maxwell Feb. 1979 246 p refs
(Contract N60530-78-C-0009)
(AD-A068389; ERIM-132300-2-F) Avail: NTIS HC A11/MF A01 CSCL 08/7

Data on various terrain backgrounds were collected and analyzed to present their statistical features. Some of those characteristics are described in the form of histograms, ellipse 'pictures,' and power spectra for the following infrared spectral bands: 2.0 - 2.6, 3.0 - 4.2, 3.5 - 3.9, 3.9 - 4.7, 4.5 - 5.5, 5.1 - 5.7, and 9.0 - 11.4 micrometers. An attempt is made to demonstrate various meteorological and other influences on the statistics by comparing the data in different spectral regions taken at different times and under differing conditions. Using these results and those from future analyses of other scenery, one would hope eventually to be able to categorize terrain backgrounds according to a few recognizable parameters. GRA

**N79-30615#** Deutsche Akademie der Wissenschaften, Berlin (East Germany).

**FIRST RESULTS OF THE EXPERIMENT RADUGA FOR PHOTOGRAPHIC REMOTE SENSING**

H. Kautzleben, K.-H. Marek, A. Geschke, and R. Joachim *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 17-26 refs Original contains color illustrations
Avail: NTIS HC A99/MF A01

An experiment in photographic remote sensing, RADUGA (rainbow), carried out jointly by the USSR and the German Democratic Republic in 1976 is described. A multispectral camera MKF-6 and a multispectral projector MSP-4 were employed. Some examples of picture reprocessing techniques with additive color viewing are presented. Results concerning the interpretation of the photos obtained in this experiment are discussed. It is found that photos which are well suited for studying photogrammetrical and thematic sensing problems can be obtained from satellites and aircraft. Author (ESA)

**N79-30637#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.

**DIBIAS: THE DIGITAL IMAGE PROCESSING SYSTEM: SYSTEM DESIGN AND APPLICATIONS**

P. Haberaecker (Fed. Inst. for Geosci. and Natural Resources, Hannover) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 233-236

Avail: NTIS HC A99/MF A01

The DIBIAS system is reviewed and some applications of image processing in the field of remote sensing are explained. The DIBIAS system is intended to be a research oriented image processing system. Very little training should allow the user to handle the system. Immediatly after processing, the user can see the results on a color TV screen. The DIBIAS software is structured into modules; input and output programs are separated from actual image processing and several programs can be run simultaneously. The DIBIAS system can be put to optimal use when the experimenter processes pre-selected data. For most of the programs a few minutes are necessary for processing a typical multispectral image of 512x512 pixels. Author (ESA)

**N79-30639#** Engins Matra, Velizy (France).

**IMAGE DATA COMPRESSION BY SHAPE RECOGNITION AND CLUSTERING [COMPRESSION DES DONNEES IMAGES PAR RECONNAISSANCE DES FORMES ET CLUSTERING]**

Gabriel Lowitz *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 243-250 refs In FRENCH
Avail: NTIS HC A99/MF A01

A process of image compression was developed applying the thematic extraction concept to small blocks instead of the entire image while using previously developed algorithms. The theoretical aspects of the problems, the compression process of pattern identifcation by the clustering algorithm, the compression coding, the pre-treatment and pre-compression, and the global compression performances are discussed. An efficient coding was developed, consisting of limiting the transmission by pixel to a two or three bits address (instead of eight) by reference to a list of patterns in dictionary form. The reconstruction to three bits results in negligible errors. Some examples are given. Author (ESA)

**N79-30640#** Engins Matra, Velizy (France).
**PRETREATMENT OF ONBOARD SIGNALS. STUDY ON THE IMPLEMENTATION OF AN IMAGE COMPRESSOR [PRETRAITEMENT DU SIGNAL A BORD: ETUDE DE LA MECANISATION D'UN COMPRESSEUR D'IMAGES]**
A. Spiwack *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 251-253 refs In FRENCH
Avail: NTIS HC A99/MF A01

A compression algorithm for images, to be used in real time cabled logic data processing, is presented. The method consists of dividing the image in blocks of 256 pixels and then analyzing the statistics of the gray levels by histogram computation. Simple criteria permit the grouping of points in classes (clustering). Only the class averages and the numbers of the pixels belonging to a class are transmitted. The implementation of the compressor is described. Author (ESA)

**N79-30657#** Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
**OPTICAL PROCESSOR FOR SYNTHETIC APERTURE RADAR [PROCESSEUR OPTIQUE POUR RADAR A OUVERTURE SYNTHETIQUE]**
M. Laug and D. Leger *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 395-399 refs In FRENCH
Avail: NTIS HC A99/MF A01

The principle of optical processors is reviewed, showing the analogies with holography. Formulas are developed that can be used to develop specialized processors adapted to particular missions. The design of the optical processor for signal reception on the SEASAT satellite is described. It is concluded that optical processors are competitive with other techniques due to their ability to handle large rates of simultaneous data both in distance and azimuth. Author (ESA)

**N79-30658#** European Space Agency, Paris (France).
**SYNTHETIC APERTURE RADAR DESIGN FOR EARTH OBSERVATION MISSIONS**
D. Macoll and G. Dieterle *In its* Earth Observation from Space and Management of Planetary Resources May 1978 p 401-406

Avail: NTIS HC A99/MF A01

The design of a synthetic aperture radar (SAR) for use in Earth Observation Satellite missions is discussed. After highlighting all weather capability, the basic concept of the SAR and the problem of image quality is reviewed. Several SAR systems are then described and an evaluation of current technological problems and limitations is given. A brief outline of the ESA activities in preparing SAR payloads for future missions is included. Author (ESA)

**N79-30663#** Centre National d'Etudes Spatiales, Toulouse (France).
**OBLIQUE OBSERVATION BY AIRCRAFT OR SPACECRAFT [OBSERVATION OBLIQUE PAR AVION OU SATELLITE]**
M. Vieillefosse *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 441-447 refs In FRENCH
Avail: NTIS HC A99/MF A01

The variation of the ground reflection coefficient with direction was studied. Data from aerial photography and multispectral scanning from space were analyzed concluding that the ground anisotropy depends on the nature of the surface, the relative position of the sun's azimuth, the observation wavelength, and the sun's elevation. The atmospheric contribution to the phenomenon is considered to be small. It is shown that bidirectional reflectance of the surfaces, and not only the albedo, must be considered. Applications to determine the sea roughness and the vegetation structure are discussed. Author (ESA)

**N79-30665#** Academy of Sciences (USSR), Moscow. Inst. of Space Research.
**ANALYSIS OF THE INFORMATIVE CHARACTERISTICS OF SCANNER AND PHOTO IMAGES OF THE EARTH'S SURFACE**
V. V. Egorov, B. S. Zhukov, and V. A. Kotizov *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 455-464

Avail: NTIS HC A99/MF A01

The analysis of images of the earth obtained from the Soyuz-22 spacecraft by means of the MKF-6 multispectral band camera is described. The analysis of brightness contrast was carried out using the method of pair sampling with frame to frame discretization, while the analysis of spectral contrast was done by central random sampling with frame to frame discretization. The important role played by the recording of the parameters of polarization of the radiation received is discussed, showing that remote indication of water surface oil pollution is one of the most promising applications. It is concluded that the degree of homogeneity of the fragments studied can be estimated. Author (ESA)

**N79-30667#** Canada Centre for Remote Sensing, Ottawa (Ontario).
**EXPERIMENT ON LANDSAT MSS HIGH GAIN MODE**
Thomas T. Alfoeldi, Andrzej Sas-Uhrynowski (Inst. of Geodesy and Cartography, Warsaw), and Irena Majcher *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 475-481 refs

Avail: NTIS HC A99/MF A01

A comparative evaluation was conducted of LANDSAT MSS low and high gain imagery. High gain data has three times greater radiometric resolution for one-third of the radiometric range. While feature classification benefits minimally from the use of high gain data, significant improvements are expected for the identification of 'levels' or degrees of an environmental phenomenon, such as water depths, range of suspended solids concentration, and leaf areal coverage. Advantages in using high gain data also apply to the detection of sub-pixel size features and the analysis of targets under low illumination levels. Author (ESA)

**N79-30673#** Centre National d'Etudes Spatiales, Toulouse (France).
**SCANNING DEVICES FOR MEDIUM RESOLUTION CAMERAS IN THE VISIBLE AND INFRARED [DISPOSITIFS DE BALAYAGE POUR APPAREIL DE PRISE DE VUES MOYENNE RESOLUTION VISIBLE ET INFRAROUGE]**
P. Vermande and G. Thomin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 521-526 In FRENCH

Avail: NTIS HC A99/MF A01

The main characteristics of two kinds of scanning devices for medium resolution infrared video cameras are discussed. One is a wheel combined with a Schmidt telescope for scanning in the image space and the other is an oscillating mirror for scanning in the object space. The main advantage of the oscillating mirror is the reproducibility of the laws of motion. Further studies and experimentation with complete apparatus is recommended. Author (ESA)

**N79-30697#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.
**CLASSIFICATION OF MULTISPECTRAL REMOTE SENSING DATA Ph.D. Thesis - Tech. Univ., Berlin**
Peter Haberaecker Jul. 1978 135 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-571) Original contains color illustrations
(DLR-FB-77-72) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 108.10

Different concepts pertinent to classification are defined and a mathematical model, subsequently derived, is described. Various classifiers are theoretically considered. A synthetic and a natural scene, taken from a multispectral aerial photograph, are used to test and illustrate the efficiency of the various classifiers. Results are compared and a performance criteria is evolved. Further algorithms are compared and a performance criteria is evolved. Further algorithms are evaluated for feature selection and computation of indices showing the priori quality of classification. Finally, an example within the context of regional planning is examined using the classification of multitemporal image data. Author (ESA)

**N79-30842*#** Environmental Research and Technology, Inc., Concord, Mass.
**EVALUATION OF THE CAPABILITIES OF SATELLITE IMAGERY FOR MONITORING REGIONAL AIR POLLUTION EPISODES**
James C. Barnes, Clinton J. Bowley, and Hsiao-hua K. Burke Aug. 1979 97 p refs
(Contract NAS1-15307)
(NASA-CR-159107) Avail: NTIS HC A05/MF A01 CSCL 13B

A comparative analysis of satellite visible channel imagery and ground based aerosol measurements is carried out for three cases representing a significant pollution episodes based on low surface visibility and high sulfate levels. The feasibility of detecting pollution episodes from space is also investigated using a simulation model. The model results are compared to quantitative information derived from digitized satellite data. The results show that when levels are > or = 30 micrograms/cu, a haze pattern that correlates closely with the area of reported low surface visibilities and high micrograms sulfate levels can be detected in satellite visible channel imagery. The model simulation demonstrates the potential of the satellite to monitor the magnitude and areal extent of pollution episodes. Quantitative information on total aerosol amount derived from the satellite digitized data using the atmospheric radiative transfer model agrees well with the results obtained from the ground based measurements. K.L.

**N79-31725*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**COLORIMETRIC PRINCIPLES AS APPLIED TO MULTICHANNEL IMAGERY M.S. Thesis - Houston Univ. at Clear Lake City**
Richard D. Juday, Principal Investigator Jul. 1979 68 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E79-10266; NASA-TM-58215; JSC-14873) Avail: NTIS HC A04/MF A01 CSCL 05B

**N79-31727*#** Metrics, Inc., Atlanta, Ga.
**DESIGN OF A LOW-COST AUTOMATED LANDSAT DATA ANALYSIS SYSTEM Final Report**
G. William Spann, Nancy J. Hooper, and Nickolas L. Faust, Principal Investigators Jul. 1979 47 p refs ERTS
(Contract NAS8-33136)
(E79-10268; NASA-CR-161285) Avail: NTIS HC A03/MF A01 CSCL 05B

**N79-31749#** Environmental Data Service, Washington, D. C.
**ENVIRONMENTAL SATELLITE IMAGERY, MARCH 1978**
Apr. 1978 53 p refs
(PB-296057/3; KMRD-5.4-7803; NOAA-S/T-79-89) Avail: NTIS HC A04/MF A01 CSCL 04B

The hemispheric mosaics derived from Scanning Radiometer data, and prepared daily by high speed computer are described. Visible and infrared data swaths obtained while the satellite is southbound on the daylight side of the orbit are used in the 09L mosaics; infrared data swaths obtained during northbound passage are used in the 21L mosaics. The scanline signals are digitized, earth located, and repositioned on a standard polar stereographic map projection. Coastal outlines and latitude/lingitude lines at 10 degree intervals are added by the computer. Overlap between successive swaths is eliminated, with the latest data retained. GRA

**N79-32612*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**A FAST ROUTINE FOR COMPUTING**
Robert R. Jayroe, Jr. Oct. 1977 22 p
(NASA-TM-78133) Avail: NTIS HC A02/MF A01 CSCL 05B

A routine for calculating multidimensional histograms of multivariate data using a combination table look up and search procedure is described. The software was originally developed to computer four-dimensional histograms from LANDSAT multispectral imagery, but the concept can be used on other types of data and the program can be modified for the desired type of output information. Author

**N79-32622#** Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.
**ADVANCED TRAINING AND RESEARCH ON SATELLITE REMOTE SENSING TECHNIQUES AND APPLICATIONS IN THE UNITED KINGDOM AND THE UNITED STATES, 1 OCTOBER 1977 TO 30 SEPTEMBER 1978 Final Report**
Jelle U. Hielkema 1978 113 p refs Original contains color illustrations
(AGLT/RSU-Series-2/79) Avail: NTIS HC A06/MF A01

Universities and scientific research centers were visited in the U.K. and the United States in order to study different types of satellite remote sensing data for a variety of applications. The development of specific digital data processing and classification techniques for detection, quantifying, and monitoring of desert vegetation using LANDSAT multispectral data was emphasized. It is noted that research and development efforts in the field of satellite remote sensing has become more and more oriented towards computer assisted techniques for data handling, analysis, and interpretation of both environmental and earth resources satellite data. Visual photointerpretation is seen as outmoded and investment in hardware, software, and trained manpower to optimize the use of available data is strongly advised.
Author (ESA)

**N79-32623#** National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
**ELECTRONIC PROCESSING OF INFRARED SCANNER SIGNALS USING CCD MEMORY TECHNIQUES**
H. A. vanIngenSchenau 6 Oct. 1978 10 p refs Presented at 1978 Inter. Symp. on the Appl. of Charge Coupled Devices, San Diego, Calif., 25-27 Oct. 1978 Original contains color illustrations
(NLR-MP-78031-U) Avail: NTIS HC A02/MF A01

The design of a video quick look which electronically processes signals from an infrared linescanner for a moving-map presentation on TV display is described. The image memory for display is composed of 16-kbit dynamic charged coupled devices (CCD). These CCD memories are line addressable which is attractive in the case of line scan orientation for sensing and display. The video quick look system is described and the design of the CCD image memory is shown. An application of the video quick look is demonstrated for thermal infrared remote sensing. Author (ESA)

**N79-33532#** Purdue Univ., Lafayette, Ind. School of Electrical Engineering

**IMPROVEMENTS IN SOME IMAGE COMPRESSION TECHNIQUES FOR AERIAL RECONNAISSANCE ANALYSIS**
**Final Technical Report, 1 Jul. - 30 Sep. 1978**
O. R. Mitchell, S. C. Bass, E. J. Delp, T. W. Goeddel, and A. Tabatabai May 1979 102 p refs
(Contract F30602-78-C-0102; AF Proj. 2305)
(AD-A071088; RADC-TR-79-99) Avail: NTIS HC A06/MF A01 CSCL 09/4

In this study a number of image coding methods were implemented and applied to aerial reconnaissance photos for relative ranking evaluations by experienced photo-analysts. These coding methods were of three broad types: two-dimensional transform, one-dimensional hybrid, and spatial. The compression rates used were 1.6 and 0.5 bits/pixel. The effects of channel errors at a .001 error rate were also simulated and evaluated. GRA

**N79-33536#** Army Cold Regions Research and Engineering Lab., Hanover, N. H.
**A LANDSAT DATA COLLECTION PLATFORM AT DEVIL CANYON SITE, UPPER SUSITNA BASIN, ALASKA. PERFORMANCE AND ANALYSIS OF DATA**
Richard K. Haugen, Ray L. Tuinstra, and Charles W. Slaughter Feb. 1979 20 p refs
(AD-A068508; CRREL-SR-79-2)' Avail: NTIS HC A02/MF A01 CSCL 13/2

In October 1974, a LANDSAT Data Collection Platform was installed near the prospective Devil Canyon damsite on the Susitna River, south central Alaska. The development of sensor interfaces and characteristics of transmitted data for air and ground surface temperature, windspeed and wind run, water equivalent snow accumulation, and battery voltage are discussed. Temperature data are analyzed statistically and compared with data from surrounding National Weather Service stations. Although some difficulties were encountered in operation during the winter of 1974-75, it was demonstrated that the LANDSAT data collection system could provide useful environmental data from a remote, subarctic location in the winter on a near-real-time basis. GRA

**N79-33868*#** National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
**PROCEDURE FOR EXTRACTION OF DISPARATE DATA FROM MAPS INTO COMPUTERIZED DATA BASES**
Bobby G. Junkin Washington Oct. 1979 23 p refs
(NASA-RP-1048) Avail: NTIS HC A02/MF A01 CSCL 09B

A procedure is presented for extracting disparate sources of data from geographic maps and for the conversion of these data into a suitable format for processing on a computer-oriented information system. Several graphic digitizing considerations are included and related to the NASA Earth Resources Laboratory's Digitizer System. Current operating procedures for the Digitizer System are given in a simplified and logical manner. The report serves as a guide to those organizations interested in converting map-based data by using a comparable map digitizing system. Author

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# 08

# INSTRUMENTATION AND SENSORS

**Includes data acquisition and camera systems and remote sensors**

**A79-44706** **Estimation of significant wave height and wave height density function using satellite altimeter data.** R. W. Priester and L. S. Miller (Applied Science Associates, Inc., Apex, N.C.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4021-4026. 16 refs.

A technique for estimating the ocean surface roughness probability density function from satellite altimeter data is presented. Results from the application of the technique to Geos 3 altimeter data demonstrate its ability to detect both large-scale and small-scale structural deviations from the Gaussian distribution. Knowledge of the surface roughness probability density enables a direct computation of significant wave height. Significant wave height computations using the estimated quantities have been found to be in general agreement with other approaches. Density function estimation is important to precision altimeter design and has possible implications in oceanographic research. (Author)

**A79-44711** **A sequential method for filtering satellite altimeter measurements.** B. D. Tapley, B. E. Schutz, and P. A. M. Abusali (Texas, University, Austin, Tex.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4061-4070. 27 refs. Grant No. NOAA-04-7-158-44052.

Recent advances in the area of satellite altimetry have provided a data type which is applicable to the detection and monitoring of transient sea surface phenomena. With the extensive altimeter data set collected by the GEOS 3 spacecraft there is an associated need for accurate and efficient methods for editing and filtering the altimeter data. In this investigation a sequential filter is developed by assuming that the sea surface topography can be approximated by an adaptive Gauss-Markov process. The effect of geoid model errors on the filtered results is illustrated by using both 1 x 1 deg and 5 x 5 min geoid models. Finally, an application of the method to the Gulf Stream current boundary identification problem using GEOS 3 altimeter data is described. (Author)

**A79-46581** **Snow parameter determination by multichannel microwave radiometry.** R. Hofer (Bern, Universität, Berne, Switzerland) and W. Good (Eidgenössisches Institut für Schnee- und Lawinenforschung, Davos, Switzerland). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 211-224. 7 refs.

A long-term observational program on the microwave scatter and emission behavior of snow began in 1977 at a high-altitude Alpine test site. The brightness temperatures at 4.9, 10.5, 21, 36, and 94 GHz measured at different incidence and polarization angles during the first season are analyzed with the aid of correlation, factorial, and cluster algorithms. The structure mathematically found within the data is compared with classical parameters of the snow cover. The snow state changed from a high winter state to a late spring state during the measurements. At least three different snow qualities and two grades of moisture for the uppermost 10 cm of the snow layer can clearly be distinguished with a high degree of accuracy. The information content of the measurements is not substantially degraded by a reduction of the data to data as delivered by the NIMBUS-5 and as expected of the NIMBUS-G satellites. Recommendations for optimum frequencies for the remote sensing of snow are given. (Author)

**A79-48454** **Metric information from aircraft multispectral scanner /MSS/ data.** J. C. McGlone, J. R. Baker, and E. M. Mikhail (Purdue University, West Lafayette, Ind.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 274-289. 11 refs. Grant No. NOAA-04-7-158-44128. (ASP 79-132)

The paper investigates the use of first and second order Gauss-Markov processes for the rectification of aircraft digital MSS data. It is shown that the first order method can be made very competitive, in terms of execution time and accuracy, with other methods. The first order method appears to be more useful than the second order one, due to shorter execution time and slightly better results. First results from the restitution of sidelapping strips shows that positional accuracy up to 19.2 meters can be obtained as well as improvement over results of single strip methods. Elevation accuracies of up to 40.6 meters were obtained. B.J.

**A79-51265** # **Optimality criterion for the assignment of spectral regions in a multispectral television system (Kriterii optimal'nosti rabochikh zon spektrozonal'nykh televizionnykh sistem).** Iu. B. Zubarev. *Radiotekhnika,* vol. 34, June 1979, p. 33-37. In Russian.

Consideration is given to a multispectral television system for remote sensing of earth resources. A minimum error probability is devised as the criterion for assignment of spectral regions in this system. B.J.

**A79-51448** * **Active/passive scanning.** J. R. Woodfill (NASA, Johnson Space Center, Houston, Tex.) and F. J. Thomson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Conference on Lasers, Orlando, Fla., December 11-15, 1978, Proceedings. McLean, Va., STS Press, 1979, p. 442-449. Contract No. NAS9-14594.

The paper deals with the design, construction, and applications of an active/passive multispectral scanner combining lasers with conventional passive remote sensors. An application investigation was first undertaken to identify remote sensing applications where active/passive scanners (APS) would provide improvement over current means. Calibration techniques and instrument sensitivity are evaluated to provide predictions of the APS's capability to meet user needs. A preliminary instrument design was developed from the initial conceptual scheme. A design review settled the issues of worthwhile applications, calibration approach, hardware design, and laser complement. Next, a detailed mechanical design was drafted and construction of the APS commenced. The completed APS was tested and calibrated in the laboratory, then installed in a C-47 aircraft and ground tested. Several flight tests completed the test program. V.T.

**A79-53371** **The modular optoelectronic multispectral scanner system for spaceborne remote sensing.** J. Bodechtel (Zentralstelle für Photogrammetrie, Munich, West Germany), O. Hofmann, B. Kunkel, and D. Meissner (Messerschmitt-Bölkow-Blohm GmbH, Unternehmensbereich Raumfahrt, Ottobrunn, West Germany). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-241.* 11 p.

A multispectral scanner system for spaceborne remote sensing of land and coastal/ocean features under development for the German Ministry for Research and Technology is surveyed. The system is based on the use of multilinear detectors arrays for visible, near, medium, and thermal infrared spectral channels. In addition, the electronically scanning image system MOMS (Modular Optoelectronical Multispectral Scanner) is examined, noting that it consists of individual spectral channel modules which can be grouped to dedicated mission tasks, e.g., land surface thematic mapping. Finally, the basic performance data which would allow up to 10,000 pixels per scan line, corresponding to about 20 m resolution at a 200 km swath width, is covered. M.E.P.

## 08 INSTRUMENTATION AND SENSORS

**A79-53373** **Feature specific spatial- and spectral sensors - Artificial retinas in space.** N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West. Germany, Sept. 17-22, 1979, Paper 79-243.* 12 p. 5 refs.

The spectral and spatial correlation techniques which can be easily implemented on-board of satellites are considered. A method which defines a number of spectral filters which cover a large part of the spectrum is described. The transmittance curves of these filters are derived from the reflection spectra of a user defined set of materials and are feature specific. An example is given with three filters derived from the reflectance spectra of water, soil, and grass, and after a linear transform the three correlation signals are coded in three colors. In spatial domain, feature specific filters for contour and line detection are proposed, and correlation operators are defined in a manner analogous to the interconnection patterns on the human eye retina. A coding scheme for printing these spatial features is given, and resolution and data rates of the combined sensor system and the user aspects are discussed. A.T.

**A79-53511** **Snow/cloud discrimination staring mode radiometer.** W. J. Stebbins (Westinghouse Electric Corp., Baltimore, Md.). In: Electro-Optics/Laser Conference and Exposition, Boston, Mass., September 19-21, 1978, Proceedings. Chicago, Industrial and Scientific Conference Management, Inc., 1978, p. 289-295.

A new supplementary sensor system has recently been delivered to the USAF/SAMSO for use on the Defense Meteorological Satellite Program. This staring mode radiometer is a snow versus cloud discrimination instrument which senses reflected solar energy in the 1.5 to 1.6 micron band. It has a spectral filter, f/1.7 lens, a custom design long vane 77 Hz tuning fork chopper, and a 4 cm long line array of 48 germanium diode detectors. Each channel has an individual preamplifier, synchronous clamp, and low-pass filter. The multiplexer, 4-bit digital commandable gain control and 6-bit A/D converter are conventional CMOS circuitry. The reasons for the spectrum selected for snow/cloud discrimination, a description of the detailed block diagram, and hardware photographs with emphasis on the tuning fork chopper vanes design, the tuning fork amplitude control loop and the analog signal processing are given. (Author)

**N79-28648*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EVALUATION AND MODELING OF THE TOPOGRAPHIC EFFECT ON THE SPECTRAL RESPONSE FROM NADIR POINTING SENSORS**
Brent N Holben and Christopher O Justice Jun 1979 24 p refs Submitted for publication
(NASA-TM-80305) Avail NTIS HC A02/MF A01 CSCL 05B

A field experiment, using a hand-held radiometer, was designed and conducted to assess a simple theoretical incidence model for simulating the topographic effect of a uniform sand surface. Seven data sets were taken to compare effects of solar elevation and azimuth encountered at different times of year. Analysis of these data showed considerable variation in radiance values for different slope angles and aspects and that these values varied considerably with changes in solar elevation and azimuth. The field measured variations in spectral response were found to have generally strong correlations with the theoretical model. The reason for the occurrence of lower correlations are given and methods for improving the model are suggested. A model to simulate LANDSAT sensor response was applied to two subsets of the field data to establish the magnitude of the topographic effect on satellite data. Author

**N79-28649*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PASSIVE MICROWAVE APPLICATIONS TO SNOWPACK MONITORING USING SATELLITE DATA**
Dorothy K Hall, James L Foster, Alfred T C Chang, and Albert Rango Jun 1979 15 p refs Submitted for publication
(NASA-TM-80310) Avail NTIS HC A02/MF A01 CSCL 08L

Nimbus-5 Electrically Scanned Microwave Radiometer data were analyzed for the fall of 1975 and winter and summer of 1976 over the Arctic Coastal Plain of Alaska to determine the applicability of those data to snowpack monitoring. It was found that when the snow depth remained constant at 12.7 cm, the brightness temperatures T sub B varied with air temperature. During April and May the production of ice lenses and layers within the snow, and possibly wet ground beneath the snow contribute to the T sub B variations also. Comparison of March T sub B values of three areas with the same (12.7 cm) snow depth showed that air temperature is the predominant factor controlling the T sub B differences among the three areas, but underlying surface conditions and individual snowpack characteristics are also significant factors. Author

**N79-29568*#** Environmental Sensing Algorithm Development Co., Sunland, Calif.
**EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SSMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM. SUB-TASK 4: INTERIM MODE T SUB B VERSUS CROSS AND NOMINAL MODE T SUB B Final Report**
J. L. Kitzis and S. N. Kitzis 27 Jul. 1979 122 p ref Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158865) Avail NTIS HC A06/MF A01 CSCL 05B

The brightness temperature data produced by the SMMR Antenna Pattern Correction algorithm are evaluated. The evaluation consists of: (1) a direct comparison of the outputs of the interim, cross, and nominal APC modes; (2) a refinement of the previously determined cos beta estimates; and (3) a comparison of the world brightness temperature (T sub B) map with actual SMMR measurements. K.L.

**N79-30584#** Construcciones Aeronauticas S.A., Madrid (Spain). Space Div.
**STUDY OF HIGH STABILITY STRUCTURAL SYSTEMS: PRE-PHASE A Final Report**
Paris ESA 29 Sep. 1978 160 p refs
(Contract ESTEC-3398/77/NL-PP(SC))
(DT-HSS-5; ESA-CR(P)-1164) Avail. NTIS HC A08/MF A01

The feasibility of large, high stability, flat, deployable antennas for earth resources observation was studied. A synthetic aperture radar antenna, 10 meters long by 1 meter wide, was taken as a representative structure of this type. Requirement definitions, interface design constraints, and a trade-off analysis of different solutions were considered. Possible design concepts and an analysis of the thermal loads were studied. Due to the different possibilities of the design configurations, strongly depending on some not well defined interfaces during development, the mechanical bahavior of the presented designs are omitted or studied in a simplified manner. Author (ESA)

**N79-30634#** Academy of Sciences (USSR), Moscow.
**REMOTE SENSING IN THE USSR ACADEMY OF SCIENCES STUDIES, EXPERIMENTS, MAIN RESULTS, CURRENT OBJECTIVES**
R. Z. Sagdeev, A. P. Kapitza, and Y. L. Ziman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 203-216 Original contains color illustrations

Avail: NTIS HC A99/MF A01

The earth remote sensing studies carried out in the USSR since 1969 are reviewed. Starting from the Salyut-1 initial experiment, aiming to develop the principles of multiband imagery, the USSR programs to study earth resources from space are detailed, including the INTERCOSMOS multi-national program, the multiband photographic survey carried out from the Soyuz 12 and 13 spacecrafts, the development of the MKF-6 multiband space camera and the MSP-4 multicamera synthesizing projector, the Soyuz-22 synthesized color images, and the RADUGA project among others. The applications, the equipment being used and the data processing are discussed. Several color synthesized photographic examples are shown. Author (ESA)

**N79-30646#** Ecole Polytechnique Federale de Lausanne (Switzerland).

**A STUDY OF SOIL HUMIDITY AND ITS VARIATIONS THROUGH REMOTE SENSING [ETUDE DE L'HUMIDITE DU SOL ET DE SA VARIATION PAR TELEDETECTION]**

P. Meylan, A. Musy, and C. Morzier (Bern Univ., Switz.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 305-313 refs In FRENCH

Avail: NTIS HC A99/MF A01

Soil humidity was determined by analysis of grand radiancy and reflectance in the microwave frequency range in order to establish a quantitative evaluation of the upper soil layers. The variations of humidity with time were studied. The usefulness of a sun radiancy model is discussed. Radiometers set at the frequencies of 4.9, 10.5, 21, and 30 GHz along with a scatterometer set at 10.5 GHz were used as well as conventional soil analysis apparatus. The results show that humidity of the upper soil layers can be estimated by single or multiple regression from the emissivity data and that the time functions of radiometric measurements are consistent with those of soil humidity. No clear conclusions were obtained about the usefulness of application of the Burke and Paris sun emission model. Author (ESA)

**N79-30650#** Centre National d'Etudes Spatiales, Toulouse (France).

**UTILIZATION OF MULTISPECTRAL THERMOGRAPHY FOR LANDSCAPE ANALYSIS [UTILISATION DE LA THERMOGRAPHIE MULTISPECTRALE DANS L'ANALYSE DU PAYSAGE]**

M. Guy, Y. Patoureaux, M. Supomo, and M. Vieillefosse *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 335-345 refs In FRENCH Original contains color illustrations

Avail: NTIS HC A99/MF A01

An airborne thermographic apparatus was developed to separate the effects of the emissivity and the temperature of the sun. After corrections for atmospheric perturbations, the spectral emissivity of the various ground objects was obtained. Two test flights were done utilizing three spectral bands and the resulting data was processed obtaining color synthesized photographs. The results show that the resultant estimated temperatures are close to the actual values. Suggestions for further improvment and applications are given. Author (ESA)

**N79-30653#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronike.

**MEASUREMENTS OF SPECTRAL CHARACTERISTICS OF NATURAL SCIENCES**

R. Staetter and M. Schroeder *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 361-365 refs

Avail: NTIS HC A99/MF A01

The radiometric field measurement technique is presented. The instrumentation and equipment used in a mobil laboratory is described. In particular, the characteristics of the the Barnes 12-550 spectroradiometer and the Bendix scanner for visible/near infrared spectra are detailed. Examples of field measurements are given. The system can be used as a local check of remote sensing measurements as well as to determine reflection characteristics in the band 0.4 to 1.1 micrometers, valuable for interpretation of multispectral images. Author (ESA)

**N79-30654#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mirkrowellen.

**SEA-STATE MEASUREMENTS AND RADAR IMAGING FROM SPACELAB 1**

F. Schlude, M. Kleintz, and M. Werner *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 369-375 refs

Avail: NTIS HC A99/MF A01

A microwave remote sensing experiment (MRSE) to be flown as part of the first Skylab payload is presented. The main experiment objectives are measuring the directional wave height spectrum of the sea surface and radar imaging of land surfaces. The instrumentation of MRSE is described. A survey about data processing on ground is included. Another experiment involving demonstration measurements by the two frequency method from a stationary platform is presented. After an introduction to the theory of the two frequency method, a description of the instrumentation is given. Results of The experiment are discussed.

Author (ESA)

**N79-30655#** Technische Hogeschool, Delft (Netherlands).

**RADAR REFLECTOMETRY IN THE NETHERLANDS: MEASUREMENT SYSTEM, DATA HANDLING, AND SOME RESULTS**

M. K. Smit *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 377-387 refs

Avail: NTIS HC A99/MF A01

A general discussion of the reflection mechanism is offered to support the argument that it is necessary to average over a number of independent measurements in order to get an accurate measurement result. One way to get a number of independent measurements is to lock at a target at several system-frequencies. With this aim an FM-CW radar was used. The number of independent measurement samples gained in This way, however, is not sufficient, so the method is employed on a number of independent, statistically identical targets. The measurement procedure, which takes this requirement into account and yet allows for quick data collection, is discussed and the method of data storing and data handling is covered. Some measurement results are given to illustrate the method. Author (ESA)

**N79-30656#** Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.

**A RADIOMETER SYSTEM WITH HIGH ABSOLUTE ACCURACY**

Niels Skou *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 389-394 refs

Avail: NTIS HC A99/MF A01

A multifrequency radiometer system including a conically scanning antenna was developed and manufactured. The system is designed for collecting glaciological and oceanographic data and is intended for airborne use. The radiometers, at 5, 17 and 34 GHz, are described with special emphasis on The methods and principles implemented to ensure the high absolute accuracy needed for oceanographic purposes. The noise-injection technique, utilized in radiometer system, yields high absolute accuracy provided that all the front and microwave components are enclosed in a temperature stabilized box kept at a temperature equal to the radiometric reference. A very accurate digital thermometer is used to monitor the temperatures of critical components and corrections to the radiometric data can be performed.

Author (ESA)

**N79-30659#** Saab-Scania, Linkoping (Sweden).

**SURFACE ROUGHNESS MEASUREMENT BY RADAR ALTIMETRY**

S. R. J. Axelsson *In* ES^ Earth Observation from Space and Management of Planetary Resources May 1978 p 407-416 refs

Avail: NTIS HC A99/MF A01

The basic principles of radar altimetry applied to the measurement of surface roughness height are discussed. Both beam and pulse limited systems are treated. The pulse limited

systems are attractive in spaceborne applications due to the moderate requirements on antenna size and attitude control. However, a much higher transmitted power must be generated than in the beam limited system, which also gives a more well defined sensitivity beam. The low average output power of conventional short-pulse radars can be overcome by using frequency modulated radars. Various types of FM radar altimeters are discussed including pulse compression technique. The possibility for using the range noise level as a measure of the roughness height in beam limited systems is pointed out. It is also shown that the distribution of The roughness height can be estimated by using the information of the fading envelope.
Author (ESA)

**N79-30660#** Heriott-Watt Univ., Edinburgh (Scotland).
**THE REMOTE SENSING OF SURFACE ATMOSPHERIC PRESSURES: AN ACTIVE MICROWAVE SYSTEM**
H. W. Lightfoot, D. A. Flower, C. Gatley, and G. E. Peckham *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 417-419

Avail: NTIS HC A99/MF A01

A proposal is made for a microwave pressure sounder to determine surface atmospheric pressure by measurement of the integrated transmission of the atmosphere at several discrete frequencies in the wings of the oxygen absorption band. Pulses of microwave energy are transmitted vertically downwards from a space platform and reflected back from the ocean surface. The ratio of return signal strength to transmitted signal strength is a measure of the atmospheric transmission which is in turn a function of The atmospheric pressure. Measurements at several frequencies are required to eliminate the effects of clouds, changes in ocean surface reflectivity, etc. Since the total absorbing path must be known, the components of the signal reflected from clouds can be rejected. A power rating system operating at two frequencies around 55 GHz was built and is in use on a horizontal ground path as part of the feasibility study for the proposed space flight instruments. Results from this work are discussed.
Author (ESA)

**N79-30661#** European Space Research and Technology Center, Noordwijk (Netherlands).
**SIGNAL PROCESSING ASPECTS OF SPACEBORNE SYNTHETIC APERTURE RADAR SYSTEMS**
R. W. Okkes *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 421-428

Avail: NTIS HC A99/MF A01

Signal processing aspects of active microwave systems used for remote sensing of the earth by satellites are discussed. After indicating the general objectives of remote sensing, an outline is given of the radar system concept presently envisaged by the European Space Agnecy to form part of the payload of a European earth resources satellite. The resulting spaceborne radar system is shown to require synthetic aperture techniques. The principle of operation is briefly explained. The speed and complexity of he processing operations are indicated and a challenging alternative option for performing the image generation in real-time using charge coupled devices technology is presented in some detail.
Author (ESA)

**N79-30662#** Institut Geographique National, Paris (France).
**STEREOSCOPY FROM SPACE [STEROSCOPIE SPATIALE]**
A. Baudoin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 431-440 refs In FRENCH
Avail: NTIS HC A99/MF A01

The applications of spatial stereoscopy are reviewed and the experience obtained through the Apollo, Skylab, and LANDSAT missions is described. The technical problems associated with the type of sensor used in photogrammetry are examined. Other possible applications such as stereoradiometry, image interpretation, and pseudostereoscopy are mentioned. Uses of stereoscopy in future satellites are detailed.
Author (ESA)

**N79-30664#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
**USE OF A METRIC CAMERA IN SPACELAB**
M. Schroeder and G. Konecny (Techn. Hochschule, Hannbver) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 449-454 refs

Avail: NTIS HC A99/MF A01

An experiment that will use a high resolution photogrammetric camera, to be included in the first Spacelab mission, to obtain metric quality photographs of the earth's surface is described. Improved satellite imagery is expected from this experiment as well as a demonstration of the use of photographs from space for mapping purpose. Objectives of the experiment, the camera system, the experiment parameters, and image quality are discussed.
Author (ESA)

**N79-30666#** Battelle Inst., Frankfurt am Main (West Germany).
**REMOTE SENSING OF ATMOSPHERIC TRACE GASES BY DIFFERENTIAL ABSORPTION SPECTROSCOPY**
W. Englisch and W. Wiesemann *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 465-473 refs Sponsored by DFVLR-BPT

Avail: NTIS HC A99/MF A01

A remote sensing system which is based on differential absorption measurements in the IR spectral region is described. The heart of the system is two tunable continuous wave CO2 lasers with their beams directed to the earth's surface and an optical superheterodyne receiver which detects and analyses the diffusely backscattered laser light. Fundamental spectroscopic data were provided by measuring the pressure-dependent absorption cross sections of relevant molecular gases for a set of discrete laser wavelengths. As a first step towards a spaceborne system, an airborne model was developed and successfully tried at flight altitudes from 300 m to 1200 m. By extrapolating the measured data it is concluded that the measuring range can be extended to Spacelab altitudes.
Author (ESA)

**N79-30668#** Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
**FAST INFRARED INTERFERENTIAL SPECTROMETER FOR THE SYSTEMATIC OBSERVATION OF SITES [SPECTROMETRE INTERFERENTIEL INFRAROUGE RAPIDE POUR L'OBSERVATION SYSTEMATIQUE DES SITES]**
Georges Gauffre *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 483-488 ref In FRENCH
Avail: NTIS HC A99/MF A01

A Fourier transformation spectrometer, able to gather infrared spectral data on targets with near to ambient temperature, being sensitive to infrared between 3 and 12 micrometers in wavelength is described. Important characteristics of the instrument include a differential operating mode which compares with a reference black body and the feature of scanning the whole spectrum in 0.1 seconds. The interferometer is associated to an steerable telescope for observing distant targets. A minicomputer handles data acquisition and data processing. Results are furnished as the absolute value of spectral luminances.
Author (ESA)

**N79-30669#** Thomson-CSF, Boulogne-Billancourt (France). Div. Tubes Electroniques.
**CHARACTERISTICS AND UTILIZATION OF CHARGE TRANSFER PHOTOSENSITIVE RODS [CARACTERISTIQUES ET UTILISATION DES BARRETTES PHOTOSENSIBLES A TRANSFERT DE CHARGE]**
Blamoutier and Descures *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 489-494 refs In FRENCH
Avail: NTIS HC A99/MF A01

Principles and construction of photosensitive rods built on a silicon substrate, capable of light intensity readings through a charge transfer mechanism, is described. The sensitivity spectral response, modulation transfer characteristics, and frequency response are examined as well as different possible functioning modes. The performance of two rods, having 512 and 1728 elements, respectively, is presented. The potential evolution of the performance of these devices, considering spaceborne applications, is discussed. Author (ESA)

**N79-30670#** Centre National d'Etudes Spatiales, Toulouse (France).

**THE CHARGE TRANSFER DEVICES AND THEIR APPLICATIONS TO THE OBSERVATION OF THE EARTH [LES DISPOSITIFS A TRANSFERT DE CHARGES ET LEURS APPLICATIONS A L'OBSERVATION DE LA TERRE]**

Laporte *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 495-508 In FRENCH

Avail: NTIS HC A99/MF A01

Several techniques for the construction of photosensitive charge transfer devices are examined. Data on experimental measurements and performance are given and two instruments of this kind are described. Data on some charge transfer device characteristics are presented in table form. Examples of photographs taken in four spectral bands by the push broom 1728 camera are included. Author (ESA)

**N79-30671#** Centre National d'Etudes Spatiales, Toulouse (France).

**HIGH RESOLUTION MULTISPECTRAL CAMERA [CAMERA MULTISPECTRALE A HAUTE RESOLUTION]**

G. Otrio *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 509-515 In FRENCH

Avail: NTIS HC A99/MF A01

The specifications of the high resolution video to be included in the SPOT satellite mission, and the selection of techniques to meet these specifications are discussed. The instrument is composed of a seven lens dioptric telescope, a detector based on photosensitive charge transfer rods, and auxiliary mechanisms. It is concluded that the selection of a push broom type instrument has the greatest potential for this application because of its simplicity and performance. Author (ESA)

**N79-30672#** Societe Anonyme d'Etudes et Realisations Nucleaires, Limeil-Brevannes (France).

**HIGH RESOLUTION CAMERA: INTERRELATION BETWEEN DETECTOR CONFIGURATION AND SPACECRAFT SYSTEMS [PRISE DE VUE A HAUTE RESOLUTION INTERRELATIONS ENTRE CONFIGURATION DES DETECTEURS ET SYSTEME SPATIAL]**

A. Alouges, C. Pezant, and A. Semichon *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 517-519 In FRENCH

Avail: NTIS HC A99/MF A01

The interrelation between the detector configuration in the optical focal plane of a spaceborne high resolution camera and the attitude control and stabilization systems of a satellite is examined in order to determine optimization criteria for the detector configuration as a function of system constraints. Push broom scanning and scanning with integration and line charge transfer are studied. The advantages of the system with integration mainly in signal gain and signal to noise ratio due to the increase in exposure time, are pointed out. The constraints that this mode of operation impose on the spacecraft systems are discussed. Author (ESA)

**N79-30675#** Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse (France).

**CALIBRATION, USING THE MOON, OF SATELLITE-BORNE INFRARED CAMERAS FOR EARTH OBSERVATION [CALIBRATION AU MOYEN DE LA LUNE DES INSTRUMENTS DE PRISE D'IMAGES INFRAROUGES EMBARQUES SUR SATELLITES D'OBSERVATION TERRESTRE]**

J. Gay and G. Lebegue (Aerospatiale, Cannes, France) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 533-540 refs In FRENCH

Avail: NTIS HC A99/MF A01

A feasibility study of calibration by means of the moon was done, for application on METEOSAT satellites, in order to compensate for the insufficiency of the internal calibration systems. Pyrometric calibration, based on pairs of temperature measurements taken on definite points on the moon by the satellite photometers, is discussed. The method will be tested on the first METEOSAT mission. Applications to other infrared earth observation satellites are foreseen. Author (ESA)

**N79-31249#** Thomson-CSF, Meudon-la-Foret (France).

**STUDY OF THE DEFINITION OF A GROUND SAR PROCESSOR FOR SEASAT-A Final Report**

Heraud, Schang, Anthouard, Carre, Y. Legal (CIMSA), J. C. Gilbert (CIMSA), and Timsit (Adersa Gerbios) 1978 136 p
(Contract ESA-3350/77-NL-HP(SC))
(ESA-CR(P)-1199) Copyright. Avail: NTIS HC A07/MF A01

A ground processor for the SEASAT A - synthetic aperture radar (SAR) is discussed. The solutions retained for the processing as well as the equipment performance specifications are given. Solutions, such as going from a high throughput rate to low throughput rates with intermediate high density data transmission buffering to bring down the input data rate were considered. All solutions are based on the use of parallel one bit processors which form the basic building block of the PROPAL II processor. Such an architecture was demonstrated to be able to adapt to varied processing requirements and, therefore, its flexibility and growth potential is important. The processor configuration retained was optimized for cost at the expense of throughput performance. Author (ESA)

**N79-31704#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

**AN ATTITUDE SENSING TECHNIQUE FOR SOUNDING ROCKETS, USING RF-INTERFEROMETRY**

G. Mayer and G. E. Todd *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 483-486 refs

Avail: NTIS HC A23/MF A01

A simple attitude sensing system which was primarily designed for use on earth survey rockets, but is also of use for the attitude stabilization of all types of space vehicles is presented. The system uses an airborne radio direction finder or interferometer to control the payload in the propagation direction of the incident wave from UHF transmitter beacons located at the points of interest in an earth resources survey. Author (ESA)

**N79-31747#** Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.

**STUDY OF SAR FOR THE EUROPEAN REMOTE SENSING PROGRAM: EXECUTIVE SUMMARY Final Report**

11 Dec. 1978 114 p refs Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen and Selenia S.p.A., Rome Original contains color illustrations
(Contract ESA-3523/78-F-CG(SC))
(ESA-CR(P)-1174) Avail: NTIS HC A06/MF A01

A detailed analysis of system specification, spacecraft interfaces, the influence of system geometry, image quality requirements, and processing tasks is presented followed by a trade-off study leading to the choice of orbit altitude, look angle, pulse duration, pulse repetition frequency, antenna dimensions, radar resolution, RF power, onboard/onground interface, and downlink modulation technique. The main critera directing the trade-off study were the reduction of the RF power and the compatibility with present platform design. A baseline configuration scheme is given, showing a resulting 310 W average RF power or an orbit altitude of 822 km. Author (ESA)

**N79-31748#** Eurosat S.A., Geneva (Switzerland).

**STUDY ON THE IDENTIFICATION OF SERVICES AND ORGANIZATIONS INTERESTED IN THE USE OF THE SPACELAB METRIC CAMERA Final Report**

C. L. P. Miller 15 Dec. 1978 89 p
(Contract ESA-3537/78-F-HC(SC))
(CLP/PR/3278; ESA-CR(P)-1184) Avail: NTIS HC A05/MF A01

Nine countries in Africa were visited and 40 organizations contacted. Results show that there is a great interest in the use of the Spacelab metric camera. The main cartographic interest involves the revision of existing maps, particularly on the 1:200,000 and 1:250,000 scale and the making of new topographic maps primarily scaled at 1:50,000 which presently exist for only about 18 percent of Africa. For thematic applications the camera technical characteristics are appreciated. Certain limitations in the performance of the camera, and the capability of various African organizations to use the product are discussed. Author (ESA)

**N79-31850#** Sandia Labs., Albuquerque, N. Mex.
**IN SITU ENVIRONMENTAL SAMPLER (IES): DESCRIPTIVE ANALYSIS AND OPERATING PROCEDURES**
F. R. Gustke Mar. 1979 109 p
(Contract EY-76-C-04-0789)
(SAND-78-1342) Avail: NTIS HC A06/MF A01

A self-contained, portable, analog tape-recording system was designed to record sample data on environments encountered during transportation. This highly versatile, rugged instrument will record in situ up to 14 channels of data, along with IRIG time and voice, with a maximum frequency response of dc to 5 kHz at tape speeds from 3-3/4 to 15 inches per second. The system and operating procedures for its use are described. DOE

**N79-33529*#** Environmental Sensing Algorithm Development Co., Sunland, Calif.
**EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM Final Report**
J. L. Kitzis and S. N. Kitzis 28 Sep. 1979 148 p Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-162346) Avail: NTIS HC A07/MF A01 CSCL 14B

An evaluation of the versions of the SEASAT-A SMMR antenna pattern correction (APC) algorithm is presented. Two efforts are focused upon in the APC evaluation: the intercomparison of the interim, box, cross, and nominal APC modes; and the development of software to facilitate the creation of matched spacecraft and surface truth data sets which are located together in time and space. The problems discovered in earlier versions of the APC, now corrected, are discussed. A.W.H.

**N79-33531*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**AN IMPROVED SCHEME FOR THE REMOTE SENSING OF SEA SURFACE TEMPERATURE**
G. Dalu (CNR, Ist. di Fisica della Atmosfera, Rome), C. Prabhakara, R. C. Lo (Computer Sci. Corp., Silver Spring, Md.), and M. J. Mack (Computer Sci. Corp., Silver Spring, Md.) Jul. 1979 29 p refs
(NASA-TM-80332) Avail: NTIS HC A03/MF A01 CSCL 08J

A radiometer which possesses two channels in the 11 to 13 micrometer window region is discussed. The radiometer is used to estimate the sea surface temperature within an accuracy of 1 C. A mathematical model is presented to show that the accuracy is improved to within 0.3 C with an independent estimate of total precipitable water vapor. A broadband channel in the 18 micrometer water vapor band is introduced in addition to the two former channels to remotely sense the total precipitable water vapor. The effect of the surface emissivity is taken into account in the scheme. A.W.H.

# 09
# GENERAL

**Includes economic analysis.**

**A79-45423 * #** **A Microwave Radiometer Spacecraft, some control requirements and concepts.** U. M. Lovelace (NASA, Langley Research Center, Hampton, Va.). In: Guidance and Control Conference, Boulder, Colo., August 6-8, 1979, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979. 8 p. (AIAA 79-1777)

A general overview of a conceptual design for a Microwave Radiometer Spacecraft using a large passive reflector, microwave radiometers, and advanced control concepts is presented. The mission requirements, developed around high resolution, large area mapping of soil moisture for global crop forecasting, are reviewed. These mission requirements, along with system design requirements, dictate the need for a reflector in excess of 700 meters in diameter. Conceptual designs for supporting structures and subsystems, including attitude and surface control, are summarized. (Author)

**A79-45649 #** **Satellite Remote Monitoring Systems - General requirements and a proposed new approach.** K. Singh and G.-P. Forcina (COMSAT General Corp., Washington, D.C.). In: International Conference on Digital Satellite Communications, 4th, Montreal, Canada, October 23-25, 1978, Proceedings.
Montreal, Teleglobe Canada, 1979, p. 16-22.

This paper briefly analyzes the general requirements for the design of a Remote Monitoring System for the collection of data, via satellite, from land based monitoring sites. The existing systems are discussed, then the concept of 4/6 GHz Remote Monitoring Systems is introduced and the rationale for an experimental RMS at 4/6 GHz explained. The experimental system implemented by COMSAT General for the U.S. Geological Survey (USGS) is described and the technical characteristics of its components illustrated. Finally, the results of the experimental program are described and their impact on the design of an operational system discussed. (Author)

**A79-47260** **Space technology spinoffs.** G. Gurney (U.S. Department of Defense, Washington, D.C.). New York, Franklin Watts, Inc., 1979. 94 p. 10 refs. $5.90.

This popular work discusses the benefits derived from the NASA space program in areas including medicine, environmental protection, energy conservation and transportation. It examines the ability of space technology to meet the needs of society and its transfer into everyday life. Various contemporary and future space missions, including Landsat, Nimbus and GEOS are examined with reference to future possibilities of technology transfer. C.F.W.

**A79-48464** **Proposal for a national high-altitude photography data base.** P. A. Antill (U.S. Geological Survey, Reston, Va.) and J. A. Gockowski (U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 551-555. (ASP 79-197)

The paper is concerned with the development of a proposal for a national high-altitude photography data base. The proposal is limited to the conterminous United States, an area of about three million square miles. The proposal is discussed relative to coverage and schedule, aircraft, cameras and film types, cycle, season, and storage and dissemination of products. This proposal has many advantages, the most important being a cost reduction from present federal agency operating costs, with no increase in staffing, to obtain national photographic coverage. The two cameras used will provide B/W mapping photographs at 1:80,000 scale and higher resolution CIR resource photographs at 1:58,000 scale to meet many of the user agencies' requirements. By pooling funds and coordinating priorities, national high-altitude photographic coverage could be completed in 3 to 4 years. S.D.

**A79-53372** **The remote sensing programme of the European Space Agency /ESA/.** C. Honvault (ESA, Earth Observation Programme Dept., Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-242.* 14 p.

The paper presents a brief survey of previous studies and developments, work presently underway, and future plans of the Remote Sensing Programme of the European Space Agency. The discussion covers the following: the earthnet program, first Spacelab payload experiments (metric camera and microwave remote sensing experiment), microwave experiment for first Spacelab payload, preparation of a European remote sensing satellite program proposal (mission objectives and requirements, feasibility studies, SAR studies, and Phase A studies on satellite systems). Attention is given to the remote sensing preparatory program. Experimental programs based on extensive ground and airborne measurements are required to develop applications and familiarize future users with remote sensing data. The overall plan of the program is tabulated. S.D.

**A79-53443** **Legal aspects of remote sensing.** R. H. Coljee. *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 12-22, 1979, Paper 79-ST-01.* 5 p.

Art. II of the Outer Space Treaty foresees absolute freedom in outer space, while, in accordance with Art. III, states are permitted to carry out activities that comply with the international law. The present paper addresses the question whether remote sensing from satellites complies with the treaty. The USA is advocating total freedom both for acquisition and dissimination of remotely sensed data, while the USSR advocates the introduction of certain constraints both on acquisition and dissimination. It is suggested that the danger of misuse could be avoided by informing any country whenever data on this country are provided to another country or institution, and identifying the data. V.P.

**A79-53527 *** **Remote sensing of earth from space: Role of 'smart sensors'; Proceedings of the Conference, Hampton, Va., November 14-16, 1978.** Conference sponsored by the American Institute of Aeronautics and Astronautics and NASA. Edited by R. A. Breckenridge (NASA, Langley Research Center, Hampton, Va.). New York, American Institute of Aeronautics and Astronautics, Inc. (Progress in Astronautics and Aeronautics. Volume 67), 1979. 520 p. $42.50.

The papers in this volume cover a wide range of topics, from user requirements for 'smart' sensors to the development of innovative solid-state devices. By definition, a 'smart' sensor can, by means of its data/information processing capability, extract much more information than a simple sensor from the received physical signals, disregard or discard data with little or no information content, and handle efficiently the large volumes of data to be generated in future spacecraft. User concepts for 'smart' sensors are considered, and the topic of data processing systems is addressed. Attention is given to advanced device technology which brings forth unique device concepts applicable to 'smart' sensors. Also discussed are data preprocessing techniques. S.D.

**N79-28191#** Committee on Science and Technology (U. S. House).
**OVERSIGHT: PRESIDENT'S CIVILIAN SPACE POLICY**

Washington GPO 1979 69 p Hearing before the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 14 Feb. 1979
(GPO-44-319) Avail: Comm. on Sci. and Technol.

Testimony was given on the contents of the president's view on the future of space programs. A clarification on the nature and scope of the administraton's space policy was reported. Some of the space programs discussed were: space shuttles, LANDSAT satellites, earth resource allocations, and environmental monitoring. M.M.M.

**N79-28207#** New Mexico Univ., Albuquerque. Technology Application Center.

**THE SKYLAB PROGRAM, VOLUME 1. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1972 - Dec. 1974**

Gerald F. Zollars Apr. 1979 46 p Sponsored in part by NTIS
(NTIS/PS-79/0335/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 22A

Articles concerning Skylab mission planning, the Earth Resources Program, development of the Apollo telescope mount, remote sensing, orbital workshops, aerospace medicine, the SKYLAB Student science program, and early research results of of experiments performed aboard SKYLAB are reported. GRA

**N79-28643*#** Humboldt State Univ., Arcata, Calif. Center for Community Development.

**DEVELOPING AND DEMONSTRATING AN INSTITUTIONAL MECHANISM FOR TRANSFERRING REMOTE SENSING TECHNOLOGY TO 14 WESTERN STATES USING NORTHERN CALIFORNIA AS THE TEST SITE Final Report, 1 Jun. 1977 - 31 Dec. 1978**

Donna Hankins, Principal Investigator 31 Dec. 1978 622 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-2244)
(E79-10229; NASA-CR-158758; Rept-3) Avail: NTIS HC A99/MF A01 CSCL 05B

**N79-29591#** Hawaii State Dept. of Planning and Economic Development, Honolulu. Land Use Div.

**HAWAII'S RESOURCES: INVENTORY AND POLICIES. A PROTOTYPE DEMONSTRATION FOR THE ISLAND OF KAUAI Final Report**

1978 155 p
(PB-294504/6) Avail: NTIS HC A08/MF A01 CSCL 13B

The State and Land Resources Policy Project had the objectives to develop: (1) policies for the preservation and management of Hawaii's resources; and (2) a resource base inventory (RBI) system to assist decision makers in implementing those policies. The RBI, in both its bibliographic and cartographic (resource map) demonstration versions for Kauai, should prove to be a valuable tool for resource planners, managers, and decision makers. GRA

**N79-30613#** European Space Agency, Paris (France).

**EARTH OBSERVATION FROM SPACE AND MANAGEMENT OF PLANETARY RESOURCES**

J. Plevin, ed., V. Hood, ed., T. D. Guyene, ed., and S. Adamy May 1978 671 p refs Partly in FRENCH and ENGLISH Proc. of ESA/CNES Intern. Conf., Toulouse, 6-11 Mar. 1978; co-sponsored by Council of Europe, CEC, European Assoc. of Remote Sensing Labs. Original contains color illustrations
(ESA-SP-134) Avail: NTIS HC A99/MF A01

The state of the art of satellite observation technology and considerations on the management and economic aspects are reviewed.

**N79-30630#** European Space Research and Technology Center, Toulouse (France).

**THE EARTH OBSERVATION PROGRAM OF THE EUROPEAN SPACE AGENCY**

D. Lennertz and I. Pryke *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 163-176

Avail: NTIS HC A99/MF A01

The earth observation program of the European Space Agency is reviewed. Activities in the fields of meteorology, climatology, geodesy, and remote sensing are covered. Several projects are described, including METEOSAT, SEOCS, BIRAMIS, SLALOM, LASSO, SONG and SPACELAB. Applications of spaceborne radar and microwaves for remote sensing are explained. A proposal for an European remote sensing satellite is discussed. Author (ESA)

**N79-30631#** Centre National d'Etudes Spatiales, Toulouse (France).

**THE SPOT PROGRAM [LE PROGRAMME SPOT]**

M. Cazenave *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 177-185 In FRENCH
Avail: NTIS HC A99/MF A01

The earth satellite observation program 'SPOT' is a polyvalent system mounted on a multifunction platform which is adaptable to various payloads. The first mission is related to territory utilization, and will be implemented by a payload operating in the viable spectrum, consisting of two identical high resolution instruments. This first payload offers the possibility of observing any zone with an average delay of 2.5 days of latitudes higher than 45 deg and the possibility of obtaining stereoscopic images with an angle of about 30 deg with a delay of one day between both images. Author (ESA)

**N79-30632*#** National Aeronautics and Space Administration, Washington, D. C.

**THE LANDSAT PROGRAM: THE PRESENT AND PROSPECTS**

Ruth I. Whitman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 187-195 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

The LANDSAT program is described and the benefits derived from it are pointed out. The successive LANDSAT launchings and its respective equipment are discussed. The earth's surface covering, the techniques of relaying the information to the ground, a description of the LANDSAT D system, a comparison between the multispectral scanner on LANDSAT C and the MSS on LANDSAT D, and information about the regions of the electromagnetic spectrum covered by LANDSAT C and LANDSAT D are discussed. Author (ESA)

**N79-30633#** Canada Centre for Remote Sensing, Ottawa (Ontario).

**CANADA'S SURSAT PROGRAM**

E. Shaw *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 197-201 refs

Avail: NTIS HC A99/MF A01

The Canadian Sursat program, its origins, purpose, and expected benefits are explained. The program seeks an experimental assessment of the feasibility of satellite surveillance to meet the civilian regulatory and monitoring requirements in the time frame 1980 to 2000. Preparations are under way to receive U. S. SEASAT-A satellite data at Shoe Cove, develop optical and digital radar processing equipment and to equip two aircraft with radar. A series of application experiments will be done from mid 1978 to late 1979. If there is sufficient merit in the satellite information system, a recommendation would then be made for participation in a joint international satellite program that would be operational in the late 1980's. Author (ESA)

**N79-30676#** United Nations. General Assembly. Committee on the Peaceful Uses of Outer Space.

**GLOBAL POLITICS: THE IMPACT OF SATELLITE TECHNOLOGY**

Peter Jankowitsch *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 543-548 refs

Avail: NTIS HC A99/MF A01

The historical and organizational framework within which the international community has been attempting to cooperate in the peaceful uses of outer space is presented. The impact of satellite technology on global politics during the last two decades is stressed, in particular the rapid and widespread growth of remote sensing activities. A global remote sensing system is suggested, to be coordinated by the United Nations. Author (ESA)

**N79-30678#** ECON, Inc., Princeton, N. J.

**BENEFITS TO THE UNITED STATES FROM IMPROVED WORLDWIDE WHEAT CROP INFORMATION BASED ON LANDSAT SYSTEM OVERVIEW**

Klaus P. Heiss *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 563-574 refs

Avail: NTIS HC A99/MF A01

The Earth Resources Survey and the LANDSAT Program of NASA, in particular, were the subject of an economic evaluation in 1974. Two case studies on the application of LANDSAT data to agriculture were conducted. The value of worldwide information improvements on wheat crops is measured in the context of world wheat markets. The benefits to the United States of public LANDSAT information on wheat crops are, on the average, 235 million dollars a year. Most of these benefits accrue directly to United States consumers in the form of lower average wheat prices; at the same time production efficiency gains accrue in providing for domestic and foreign demand. These benefits are those of a system with possibly as many as three operating spacecraft of the LANDSAT-D type. The benefits compare favorably with the annual system's cost of about 80 million dollars. Author (ESA)

**N79-30679#** United Nations, New York, N. Y. Outer Space Affairs Div.

**THE ECONOMIC IMPLICATIONS OF REMOTE SENSING FROM SPACE FOR THE DEVELOPING COUNTRIES**

Adigun AdeAbiondum *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 575-583 refs

Avail: NTIS HC A99/MF A01

The prospects for the operational stutus of space programs and the impact of future space vehicles and sensors on the economy of the developing countries are examined. Many developing countries have been satisfied and encouraged with the results obtained to date from the analysis of the data (acquired by LANDSAT satellite) of their resources. Consequently, these countries are now actively seeking training opportunities for their nationals in the interpretation and utilization of space-acquired information on their land. Such an investment carries an added advantage of introducing new technology into their planning and development processes. However, the required scale of investment in a full development of the ground segment of this technology might be too taxing on the resourced of most of the developing countries: regional co-operation provides an alternative solution. Author (ESA)

**N79-30681#** London Univ. (England). Faculty of Laws.

**LEGAL IMPLICATIONS OF REMOTE SENSING FROM SPACE**

B. Cheng *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 597-612 refs

Avail: NTIS HC A99/MF A01

The applicable principles of general international law and the relevant provisions in the four multilateral treaties relating to outer space drawn up through the United Nations are examined. It is found that the existing law allows free sensing from outer space, but this conclusion is qualified by pointing to three ways whereby states might be able to contain its consequences. An analysis of the proposals currently before the United Nations, which is working on a new international instrument to govern remote sensing from outer space, and a critical examination of the progress so far made are included. Author (ESA)

**N79-30682#** Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).

**KEY EUROPEAN APPLICATIONS FOR SATELLITE REMOTE SENSING EXPERIMENTS WITH PRESENT SYSTEMS: REQUIREMENTS FOR OPERATIONAL APPLICATION**

J. Bodechtel *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 613-626 refs

Avail: NTIS HC A99/MF A01

The application of earth observation satellites for obtaining accurate and up-to-date information for survey, planning, and monitoring on a regional as well as worldwide level is discussed. Based on European user requirements, operational monitoring from space and sensor specifications are examined. Examples are drawn from LANDSAT and Skylab data. Results show that three optical payload configurations are sufficient to meet the requirements cited. These include an optical payload for medium and high ground resolution to be used in evaluating land use, extractive resources, and agricultural needs. Another optical configuration, having medium ground resolution with high spectral resolution, is needed for monitoring coastal zones and water resources. Finally, an optical payload for coarse ground resolution can be used in oceanography and the observation of polar zones. Author (ESA)

**N79-31715*#** Cornell Univ., Ithaca, N. Y.

**CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1978 - 31 May 1979**

Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Jun. 1979 221 p refs ERTS

(Grant NGL-33-010-171)

(E79-10255; NASA-CR-158861) Avail: NTIS HC A10/MF A01 CSCL 05B

**N79-31723*#** Battelle Columbus Labs., Ohio.

**REVIEW OF PRICING POLICY ALTERNATIVES FOR THE OPERATIONAL LANDSAT SYSTEM Final Report**

R. W. Earhart, Principal Investigator, J. A. Madigan, W. F. Moore, and R. F. Porter Nov. 1977 97 p refs ERTS

(Contract NASw-2800)

(E79-10263; NASA-CR-158878; BCL-OA-TFR-77-6) Avail: NTIS HC A05/MF A01 CSCL 12A

**N79-33115#** Executive Office of the President, Washington, D. C.

**AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1978 ACTIVITIES**

Jimmy Carter NASA Jul. 1979 109 p

Avail: NTIS MF A01; SOD HC as NAS1.52:978

Highlights of national aeronautics and space programs for the year are described for the following areas: communications Earth resources, space science, transportation, and space energy. Activities of NASA and five other Federal agencies with the largest programs in these areas are discussed. The national space policy statement is included in the appendixes along with records of U. S. spacecraft launchings, the history of U. S. and Soviet manned space flights; and data related to applications satellites, scientific payloads, and space probes. Budgetary summaries are included. A.R.H.

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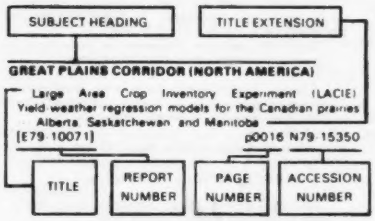
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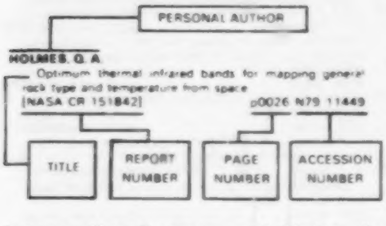

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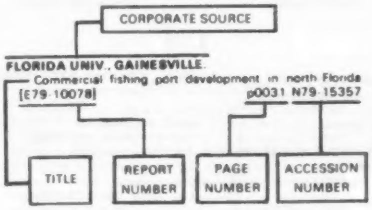

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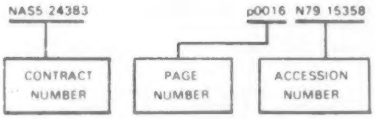

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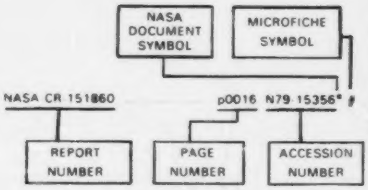

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This bibliography lists 345 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1, 1979 and December 31, 1979. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

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# EARTH RESOURCES

## A Continuing Bibliography With Indexes

## Issue 25

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1 through March 31, 1980 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

NASA Scientific and Technical Information Branch 1980
**National Aeronautics and Space Administration**
Washington, DC

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# INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumention on orbiting spacecraft or on aircraft.

This literature survey lists 380 reports, articles, and other documents announced between January 1 and March 31, 1980 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA).*

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

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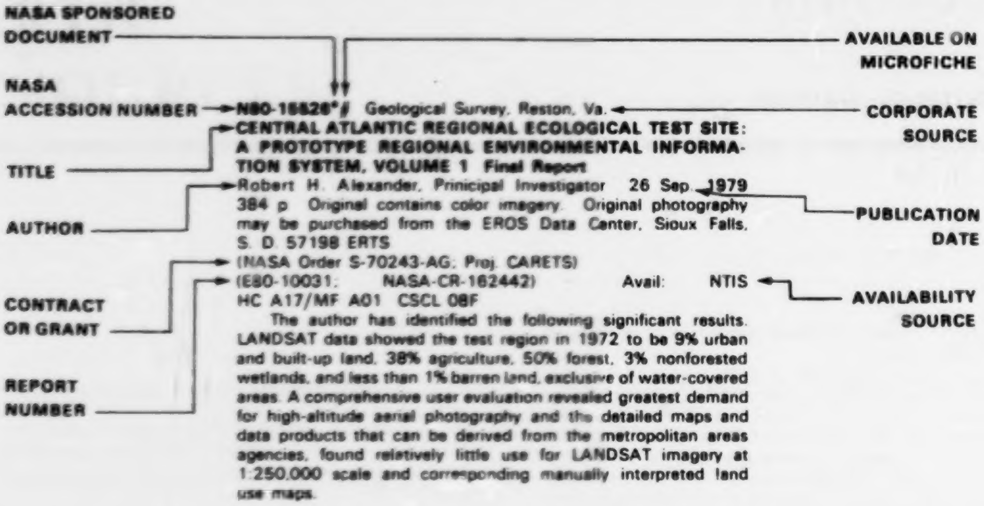
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**N80-16826*#** Geological Survey, Reston, Va.
**CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report**
Robert H. Alexander, Prinicipal Investigator 26 Sep. 1979 384 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
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The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

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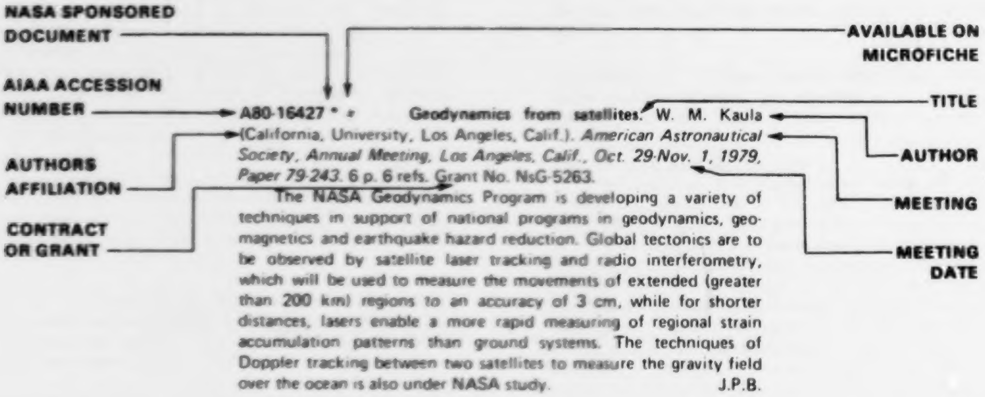
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A80-16427 * # Geodynamics from satellites. W. M. Kaula (California, University, Los Angeles, Calif.). *American Astronautical Society, Annual Meeting, Los Angeles, Calif., Oct. 29-Nov. 1, 1979, Paper 79-243.* 6 p. 6 refs. Grant No. NsG-5263.

The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geomagnetics and earthquake hazard reduction. Global tectonics are to be observed by satellite laser tracking and radio interferometry, which will be used to measure the movements of extended (greater than 200 km) regions to an accuracy of 3 cm, while for shorter distances, lasers enable a more rapid measuring of regional strain accumulation patterns than ground systems. The techniques of Doppler tracking between two satellites to measure the gravity field over the ocean is also under NASA study. J.P.B.

# EARTH RESOURCES

## A Continuing Bibliography (Issue 25)

APRIL 1980

## 01

## AGRICULTURE AND FORESTRY

**Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.**

**A80-10171** # **Digital processing of multispectral color aerial photographs of forest land (Opyt tsifrovoi obrabotki tsvetnykh spektrozonal'nykh aerosnimkov lesa).** R. I. El'man, V. M. Zhirin, and A. N. Potapov (Vsesoiuznoe Ob'edinenie Lesproekt, USSR). *Geodeziia i Aerofotos'emka,* no. 3, 1979, p. 75-79. In Russian.

The paper gives results of a machine experiment relating to the digital processing of aerial photographs of forest land. A color selection algorithm is presented for determining the parameters that influence the machine interpretation of tree types in a mixed evergreen forest, with an evaluation of the accuracy of such determination. An algorithm is also developed for the identification of damage to recently planted trees; the possibility of determining the portion of pines in pine/birch areas and of evaluating the degree of pollution damage of pines is examined. B.J.

**A80-10877** **Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters.** S. G. Banyard (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1979, p. 267-276.

It is well known that one of the main factors limiting the acquisition of aerial photographs of extensive areas in the tropics is the prevalence of cloud and mist cover. SLAR is especially useful for forest vegetation mapping in tropical regions where the acquisition of aerial photographs is difficult and often impossible due to adverse weather conditions. SLAR imagery can be interpreted for the production of thematic maps, and the paper considers this aspect of radar usefulness, with particular reference to training in forest type mapping. By carrying out a prescribed training exercise, foresters discover for themselves the difficulties and limitations associated with the interpretation of currently available radar images. The importance of reliable ground truth and the use of accurately located 'photo-truth' keys is discussed. S.D.

**A80-11708** # **Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture.** T. W. Gossard (U.S. Department of Agriculture, Forest Service, Washington, D.C.). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 726-734. 6 refs.

There are currently three systems in use within the Forest Service that use Digital Terrain Data (DTD) as source material. TOPAS (TOPographic Analysis System) was developed in-house in 1975 and is heavily used by resource managers to evaluate impacts of alternate land uses of National Forest lands. Digital Terrain Information System (DTIS) is a secondary set of programs within TOPAS that has been enhanced to handle more rigorous analyses related to site specific projects, often involving engineering reconnaissance and design. Method of Scenic Alternative Impacts by Computer (MOSAIC) was written under contract, and is a photomontage system that employs computer graphics to depict proposed landscape alterations to overlay on a terrestrial photograph of an existing area. The basic features of each system, and the primary uses of output products are discussed. (Author)

**A80-13136** **Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle.** R. D. Jackson, P. J. Pinter, Jr., S. B. Idso, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Applied Optics,* vol. 18, Nov. 15, 1979, p. 3730-3732. 9 refs.

Interactions of crop configurations with sun angle and sun azimuth influencing the spectral reflectances of wheat are investigated. Plots of wheat were planted in a dense stand with no rows, and in rows spaced 0.3 m apart running north-south and east-west. Radiances were measured when the plants were 0.35 m in height and covered 70% of the ground in the row plots by means of a radiometer having bandpass intervals similar to those of the Landsat multispectral scanner during the course of one day as the solar elevation angle and azimuth angles changed. Measurements reveal essentially no changes in IR radiances (0.8 to 1.1-micron and 0.7 to 0.8-micron bands) in the no-row plot with solar angle, with slightly greater reflectance in the afternoon than the morning, and similar variations for both row orientations. For the visible (0.6 to 0.7 and 0.5 to 0.6 micron) bands, the reflectance of the no-row plot increased abruptly at noon, the east-west plot exhibited little change with solar elevation, and the reflectance of the north-south plot increased about 2.3 times as the sun neared solar noon. It is concluded that crop configuration is a major determinant of wheat spectral reflectance and should be considered in interpreting imagery spanning a significant time. A.L.W.

**A80-13141** **Plant canopy information extraction from composite scene reflectance of row crops.** R. D. Jackson, R. J. Reginato, P. J. Pinter, Jr., and S. B. Idso (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Applied Optics,* vol. 18, Nov. 15, 1979, p. 3775-3782. 18 refs.

As an aid in the interpretation of remotely sensed data from row crops with incomplete canopies, a model was developed that allowed the calculation of the fractions of sunlit soil, shaded soil, sunlit vegetation, and shaded vegetation for each resolution element in a scan of a remote sensor for a given set of conditions (plant cover, plant height/width ratio, row spacing, row orientation, time of day, day of year, latitude, and size of resolution element). Using measured representative reflectances of the four surfaces, composite reflectances were calculated as a function of view angle. Also, representative temperatures for each surface were used to simulate composite temperatures viewed by an IR scanner. With composite reflectances and temperatures known as a function of view angle, ways were explored to extract plant cover and plant temperature data from the composite data. (Author)

**A80-13357** **Look direction modulation function of the radar backscattering coefficient of agricultural fields.** F. T. Ulaby and J. E. Bare (University of Kansas Center for Research, Inc., Lawrence, Kan.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Nov. 1979, p. 1495-1506. 9 refs.

An experimental evaluation is presented of the look direction modulation function, which describes the dependence of the radar backscattering coefficient on the orientation of the radar look direction relative to the row direction of agricultural fields. The look direction modulation function was investigated for angles of incidence from 0 deg (nadir) to 60 deg, microwave frequencies from 1 GHz to 18 GHz (30 cm to 1.67 cm in wavelength) and for all linear polarization configurations (HH, HV, and VV). Based on experiments conducted for fields of corn, wheat, and soybeans under several different growth conditions, the results indicate a strong dependence of the like-polarized radar backscattering coefficient on look direction at 1 GHz, decreasing exponentially with frequency to an insignificant dependence above 4 GHz. The cross-polarized radar backscattering coefficient shows no significant dependence on look direction at any frequency or angle of incidence. (Author)

**A80-14375** **The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones (Die Verwendbarkeit von Landsat-MSS-Bildern bei landwirtschaftlichen Planungen in tropischen Sumpf- und Regenwaldzonen).** W. Miksch. *Bildmessung und Luftbildwesen,* vol. 47, Nov. 1, 1979, p. 189-193. 5 refs. In German.

Within the frame of a cacao plantation project in the southern rain forest of Cameroon a general use of Landsat-MSS-imagery was tested for agricultural planning. Test basis was a geometrical analysis in three characteristic regions: Mangrove swamps, secondary rain forest, plantations and humid savanna. As geometrical figures points, distances and areas were tested by transformations and comparisons of image and map. The results found were some accuracy relations which admit conclusions for application of the photos in different measures of agricultural planning. (Author)

**A80-14580** **Microwave radiometric methods and the problem of forest and peat fires.** L. F. Borodin, E. N. Valendik, and A. S. Mironov. *(Radiotekhnika i Elektronika,* vol. 23, Oct. 1978, p. 2120-2131.) *Radio Engineering and Electronic Physics,* vol. 23, Oct. 1978, p. 85-93. 29 refs. Translation.

The results of works involving the use of microwave radiometry in solving the problems of forest and peat fire protection are generalized. Information is given concerning the microwave radiation of forest fires. The major tactical parts of a fire can be clearly identified through the use of airborne microwave radiometers under dense smoke conditions. The experimentally obtained spectral dependences of the absorption coefficient and emissivity of peat are presented. An estimate is given of the microwave radiation spectra of peat piles with hidden sources of dangerous heating. It is shown to be possible in principle to estimate the degree of fire danger in territories covered by forests and peat bogs by means of spectral measurements of their emissivity. (Author)

**A80-15051** **Albedo of vegetated surfaces - Its variability with differing irradiances.** K. T. Kriebel (München, Universität, Munich, West Germany). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 283-290. 7 refs. Research sponsored by the Deutsche Forschungsgemeinschaft.

The albedo of four vegetated surfaces was investigated to derive its variability with differing distributions of the irradiance. The results are based on measured values of the spectral biconical reflectance factor, which are combined with calculated spectral irradiances for low and high atmospheric turbidity. The solar zenith angle is varied from 0 to 80 deg. The derived spectral albedos are then integrated with respect to wavelength in order to achieve the albedo. It is found that the variability of the albedo with respect to the atmospheric turbidity is less than 0.01 in nearly all cases. The variability of the albedo with respect to the solar elevation angle, however, is larger than 0.02 in many cases. For solar elevation angles from 20 to 60 deg, the variability of the albedo of the four surfaces can be represented by a mean curve which fits the individual variabilities with an accuracy of 0.015. (Author)

**A80-15052** **Remotely sensed land cover temperature and soil water status - A brief review.** G. F. Byrne, J. E. Begg, P. M. Fleming, and F. X. Dunin (Commonwealth Scientific and Industrial Research Organization, Canberra, Australia). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 291-305. 42 refs.

The temperature of a plant canopy, as seen by a scanning device, is determined by plant physiological processes and environmental conditions which interact in a complex manner not readily monitored by remote sensing devices. The physiology literature is briefly considered with a view to outlining factors that may be relevant in inferring soil water content from canopy temperature. Examples of energy fluxes and temperatures observed under field conditions are discussed. (Author)

**A80-15053** **Estimating leaf-area index of wheat with Landsat data.** R. B. Pollock and E. T. Kanemasu (Kansas Agricultural Experiment Station, Manhattan, Kan.). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 307-312. 9 refs.

Foliage density is a valuable measurement for assessing crop growth, development, and yield. A relationship between foliage density and spectral intensity has been noted in several studies. In this study, an empirical model is developed to estimate foliage density, i.e., leaf area index (LAI), using Landsat multispectral scanner data. LAI measurements of wheat from several fields in three Kansas counties during three growing seasons were correlated with various transformations of Landsat multispectral scanner data. The model performed well at LAIs above 0.5, but significantly poorer below 0.5. (Author)

**A80-15057** **Measured emissivity of soils in the southeast United States.** S. E. Taylor (NOAA, Environmental Studies Service Center, Auburn, Ala.). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 359-364. 10 refs.

The thermal emissivities of exposed soil surfaces for the major soil subgroups of Alabama, Georgia, and Florida were determined. It was found that brightness temperature sensed by narrow-band infrared radiometers (10.4-12.6 microns), as used on SMS-GOES spacecraft would not deviate from thermodynamic temperatures by more than -2 C as a result of surface emissivity. Emissivity effects on the brightness temperature determined with broadband radiometers (5-15 microns), however, could be as great as -6 C. (Author)

**A80-15559** **The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest.** P. J. D. Versteegh (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1979, p. 277-291.

An experimental forest inventory was carried out in a tract of tropical rain forest of 2200 hectares on Pulau Laut, South Kalimantan, Indonesia. Shorea (Meranti) and Dipterocarpus (Keruwing) are commercially the most important timber species. The spatial distribution of the species is heterogeneous with a pronounced tendency to grouping. The discussion covers sampling design, species group, analysis, and results. The tallying of data in record units afforded analysis per species group. Four species groups are distinguished: Shorea, Dipterocarpus, Euxideroxylon zwageri (ulin or ironwood), and all species. It is shown that the expected discrepancy is not significant for five record unit sizes and four species groups, which were indeed heterogeneous in their spatial distribution. Several tables supplement the text. S.D.

**A80-15560** **Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil.** B. Kemper (IAPAR, Londrina, Brazil). *ITC Journal,* no. 2, 1979, p. 292-301. 6 refs.

**A80-15775** # **A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/.** E. M. Makhanya (London, University, London, England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 27, 29-33.

Erratic sub-tropical rainfall in the study area is very destructive on the erodible soils of this bare and rugged landscape. Soil erosion is further accelerated by poor management of agricultural resources, and is more pronounced where crops are cultivated in areas that are susceptible to erosion. The results of this study, which was carried out by air photo-interpretation and field checking, showed that about 60 per cent of the land area is subjected to severe erosion and about 37 per cent of the cultivated land is situated on it, posing an erosion hazard. (Author)

**A80-15776** # **Some applications of remote sensing in agricultural resources with reference to India.** B. Dey (Ottawa, University, Ottawa, Canada). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 35, 37-42. 20 refs.

This paper examines the present experimental and quasi-operational remote sensing activities of the Indian Space Research Organization (ISRO) and the National Remote Sensing Agency (NRSA) for their agricultural resources management programs. Airborne remote sensing with multiband and infrared false color photography has been used from various platforms, including helicopters, aircraft and balloons for crop identification, crop estimation, land use classification and the inventory of water resources. Studies in the United States, Canada and a few other countries have demonstrated the important role Landsat and NOAA provide in agricultural resources inventories and planning. Some of the satellite remote sensing techniques could be applied to India, such as the use of low resolution NOAA imagery to study the behavior of monsoon rainfall, and the use of Landsat imagery for agricultural resources inventories, land use classifications and small-scale thematic mapping for large areas. Moreover, Landsat imagery might be used to obtain the yearly estimate of India's crop acreage. By using Landsat color composites (MSS Bands 4, 5 and 7) of dry and wet seasons, a land use classification map for part of Bihar State has been prepared. (Author)

**A80-15777** # **The contribution of Landsat imagery to reconnaissance soil mapping in north-west India.** J. A. Allan (London, University, London, England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 43, 45-47. 12 refs.

Soil maps of northern India are generally inadequate and extremely difficult to locate. In addition, aerial photography is not available to scientists and administrators as a result of which information about the spatial distribution of land units, with their variation in quality, is extremely difficult to obtain. A study in Bulandshahr District in north-west India has shown that in the circumstances of this study area the spatial, spectral and temporal resolution of the Landsat system are sufficient for the delimitation of land units with soils which can support vigorous agriculture and of those where soils are degraded, or severely degraded, by saline-alkali conditions. (Author)

**A80-15778** # **The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin.** A. A. Disperati (Paraná, Universidade Federal, Curitiba, Brazil) and M. A. Keech (National College of Agricultural Engineering, Silsoe, Beds., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 49, 51-55.

Side-looking airborne radar, satellite imagery and aerial photography were used in a recent forest inventory carried out along part of the Trans-Amazonian Highway. The survey involved the examination of a 20-km wide strip centered on the line of the road starting 120 km east of the Rio Xingu and finishing 200 km west of the river. The area had several terrain forms and most of these could be clearly demarcated on the SLAR though there were areas where the image reproduction seemed blurred. River lines, most important for location purposes, were better revealed on the satellite imagery which also amplified the geomorphological information found on the radar images. Geology was best revealed on the satellite imagery. Vegetation and the precise definition of the form of the geomorphology were observed on the aerial photography. The definition and classification of the forest types was achieved by stereo interpretation. It was found possible to identify different strata in the forests to describe the forms of the crowns, or combination of crowns in each layer, and to locate certain patterns of similarity. These were converted to horizontal diagrams. There appeared to be some correlation with the geological and geomorphological forms. Patterns located on photography could be identified on the satellite imagery in several cases, but the radar images at the scale available were less satisfactory. The use of all three media increased the confidence and accuracy of the survey considerably. (Author)

**A80-20267** * **A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 579-593. 19 refs.

The first four Landsat-D thematic mapper sensors were evaluated and compared to the RBV and MSS sensors from Landsats-1, 2, and 3, Colvocoresses' proposed 'operational Landsat' three band system, and the French SPOT three band system using simulation/integration techniques and in situ collected spectral reflectance data. Sensors were evaluated by their ability to discriminate vegetation biomass, chlorophyll concentration, and leaf water content. The thematic mapper and SPOT bands were superior in a spectral resolution context to the other three sensor systems for vegetational applications. Significant improvements are expected for vegetational analyses from Landsat-D thematic mapper and SPOT imagery over MSS and RBV imagery. (Author)

**A80-20268** * **Dual polarized long wavelength radar for discrimination of agricultural land use.** W. P. Waite, H. C. MacDonald, D. N. Tolman, C. A. Barlow, and M. Borengasser (Arkansas, University, Fayetteville, Ark.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 595-607. 5 refs. Contracts No. JPL-954940; No. JPL-955048.

The scattered return of imaging radars is primarily sensitive to target structure or roughness and to composition of complex permittivity. The relative degree of penetration, or the depth of material to which the return is sensitive, also varies directly with the wavelength. Where vegetation can be eliminated as a factor, the surface return may be analyzed for variations in roughness or composition (primarily moisture content). L-band (25-cm) imagery has provided evidence that long-wavelength systems with improved penetration capability have the potential for minimizing the vegetation contribution and enhancing the surface return variations. However, the increased wavelength increases the sensitivity to large-scale structure. In the present paper, it is shown that addition of a cross polarized channel enables the interpreter to distinguish vegetation and orientation perturbations in the surface return. V.P.

**A80-20754** # **Spectral reflectance of certain weeds (Spektral'naia otrazhatel'naia sposobnost' nekotorykh sorniakov).** K. Ia. Kondrat'ev and P. P. Fedchenko (Glavnaia Geofizicheskaia Observatoriia, Leningrad, USSR). *Akademiia Nauk SSSR, Doklady,* vol. 248, no. 6, 1979, p. 1318-1320. 6 refs. In Russian.

In order to devise a method to control the weed damage of crops, a study has been undertaken in the USSR to identify and classify weed types in grain fields. This summer-1978 study involved the identification of weed types according to their spectral reflectance characteristics, measured from an airborne photometer system. Data are used in developing an algorithm of weed identification. B.J.

**A80-15779** # **Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources.** F. B. Larin-Alabi (Edinburgh, University, Edinburgh, Scotland). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 57, 59-61. 9 refs.

The paper considers problems involved in remote sensing techniques in forest surveys in Nigeria with particular emphasis on the tropical high forest as an example of a complex tropical forest system. The value of remote sensing for forest surveys has not been realized in the tropics due to the persistent cloud cover which impeded photography and made satellite sequential sensing less meaningful, and to environmental conditions limiting the interpretation of remote sensing imagery. Operational remote sensing in tropical countries is often executed by expatriates (because of lack of trained personnel) who leave the country at the conclusion of their assignments, so that the country loses their experience. To benefit from the remote sensing technology, radar should be improved because of its near-all-weather capability, and adequately equipped central and multidisciplinary remote sensing units and personnel training programs should be established. A.T.

**A80-15780** # **Digital analysis of radar imagery for vegetation detection in Nigeria.** D. J. Stanley (Logica, Ltd., London, England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 63, 65-74. 6 refs.

Single polarization X-band side-looking airborne radar imagery has recently been acquired for the whole of Nigeria for the primary purpose of generating a reliable forestry inventory to provide a baseline for management of timber resources. A microwave remote sensor was employed because of the persistent cloud cover over the equatorial region and the superior speed of acquisition for large areas. Because of the single channel nature of the imagery, conventional multivariate spectral classification is not possible, and methods have been developed to analyze and quantify the spatial intensity relationships usually described as texture. In addition to the principal aim of providing the human interpreter with a tool to quantify tone and texture relationships, research has also been oriented towards an investigation of the dependence of these quantities on system parameters such as resolution and antenna response as well as processing algorithms. Examples are selected to illustrate the need for a careful evaluation of the effects of such variables. (Author)

**A80-15783** * # **An assessment of LACIE and related methodologies for conducting crop inventories.** R. E. Tokerud and J. A. Quirein (Lockheed Electronics Co., Inc., Systems and Services Div., Houston, Tex.). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 91, 93-101. 17 refs. Contract No. NAS9-15200.

The Large Area Crop Inventory Experiment (LACIE) is a joint undertaking of the U.S. Department of Agriculture, the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, and the National Aeronautics and Space Administration. It is designed to verify an economically important application of remote sensing from earth orbital satellites. The first two phases of the experiment have been completed. A description of the experiment and a short discussion on the results and conclusions of the first two phases are presented. The LACIE design is compared with other designs for conducting crop inventories. An integrated design methodology (based upon accumulated LACIE experience) is discussed for conducting crop acreage surveys in developing countries. (Author)

**A80-16562** # **System of landscape-statistical methods for stocktaking and mapping of forests (Sistema landshaftno-statisticheskikh metodov inventarizatsii i kartografirovaniia lesov).** E. N. Kalashnikov. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 60-74, 190-192. 13 refs. In Russian.

The basic principles of a methodology based on a system landscape-statistical stocktaking and mapping methods are outlined. The correlation between the methods (and objects) of forest stocktaking and the inventory items and organization of forestry is demonstrated. The complexity of the technological processes is illustrated, and the potentialities of these processes are assessed. V.P.

**A80-16563** # **Remote identification of the spatial structure of forest phytocoenoses (Distantsionnaia indikatsiia prostranstvennoi struktury lesnykh fitotsenozov).** V. V. Kuz'michev, V. P. Cherkashin, V. Ia. Ledovskikh, and K. K. Dzhanseitov. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 75-88. 22 refs. In Russian.

Characteristic of phytocoenoses is a well-defined organization level which manifests itself in the spatial structure of tree arrangements and arrangements of groups of trees and also in the arrangement of phytocoenoses within recurrent forms of the relief. This structure is reflected on satellite photographs and can be studied by quantitative methods. In the present paper, the analysis of the frequency-spatial characteristics of wooded areas, obtained from aerial photograph density traces is demonstrated by an example. V.P.

**A80-16565** # **Mapping the soil cover of taiga landscapes by remote sensing techniques (Kartirovanie pochvennogo pokrova taezhnykh landshaftov s ispol'zovaniem distantsionnykh metodov).** V. M. Korsunov, E. E. Boboleva, V. D. Karpenko, and F. I. Pleshikov. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 135-151, 185, 188, 189, 195-197. 20 refs. In Russian.

The principles of mapping forest soils from aerial photographs are outlined, along with a structural-ecological approach to the decoding and interpretation of aerial and satellite photographs in the identification of forest soils. An effective procedure for mapping the structure of forest soil covers is proposed. V.P.

**A80-16566** # **Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography (Analiz landshaftno-ekologicheskoi priurochennosti ochagov Sibirskogo shelkopriada s primeneniem aerokosmicheskoi s'emki).** A. S. Isaev and V. Ia. Riapolov. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 152-167, 198, 199. 41 refs. In Russian.

**A80-16567** # **Remote sensing methods applied to the solution of the forest fire problem (Distantsionnye metody v reshenii problemy lesnykh pozharov).** E. N. Valendik. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 168-182. 32 refs. In Russian.

The current status of remote sensing techniques developed for combating forest fires is reviewed. Some results of the application of IR and microwave radiometery in forestry and in detection, mapping, and estimation of the rate of spread of forest fires are examined. V.P.

**A80-19543** **Crop identification with L-band radar.** F. T. Ulaby, P. P. Batlivala, and J. E. Bare (University of Kansas Center for Research, Inc., Lawrence, Kan.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Jan. 1980, p. 101-105. 9 refs.

In an experiment to classify crops based on L-band radar data a synthetic aperture radar (SAR) was flown over the test site at 2170 meters msl. L-band imagery with HH and HV polarization was obtained. Depression angle ranged from 31 degrees in the near range to 15 degrees in the far range. Radar return values were digitized as grey levels (128 steps) for classification purposes. The data obtained were normalized by range correction curves and a linear discriminant analysis was performed on the normalized data. In the classification analysis, each of the two discriminating variables, like polarization (HH) and cross polarization (HV) returns, were used singly and in combination. The analysis led to the following conclusions: it is possible to separate four categories - corn, soybeans, woods, and continuous cover - with a confidence of 71 percent if both like (HH) and cross (HV) polarization returns are used; if only one polarization is used, HH yields good overall results (65 percent) and is able to separate corn, soybeans and continuous cover crops, but woods, however are confused with crops. V.L.

**A80-19544 *** **A seasonal verification of the Suits spectral reflectance model for wheat.** E. W. LeMaster, J. E. Chance (Pan American University, Edinburg, Tex.), and C. L. Wiegand (Science and Education Administration, Weslaco, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Jan. 1980, p. 107-114. 15 refs. Grant No. NsG-9033.

Variables that characterize wheat canopies for the Suits Model and spectral bidirectional reflectance measurements in the 450 to 1350 nm interval were determined approximately weekly throughout the growing season for two cultivars of wheat that achieved maximum leaf area index of 5.3 and 10.8. The Suits Model plant variables were tabulated and experimental reflectance measurements were compared with the model predictions in the wavelength interval from 500 to 1150 nm at 50 nm increments for 17 measurement dates. The seasonal average coefficient of determination, r squared, was 0.88 between the Suits spectral bidirectional reflectance model and field-measured reflectance data. Poorest agreement was found very early and very late in the growing season, possibly due to low green plant biomass and incomplete ground cover. (Author)

**A80-20024** **Fixed-base large-scale photographs for forest sampling.** R. D. Spencer (Town and Country Planning Board, Victoria, Australia). *Photogrammetria,* vol. 35, Nov. 1979, p. 117-140. 32 refs. Research supported by the Forests Commission of Victoria, APM Forests Pty., and University of Melbourne.

The use of large-scale aerial photographs for collecting and analyzing forest inventory data (tree heights, stem diameters and crown widths) is considered. Sharp images and improved accuracies of flying heights, essential for the determination of photographic scale, were obtained with fixed-base photography. Stereoscopic pairs of macro-scale photographs were taken simultaneously from heights of 200-500 ft using twin Vinten 70-mm cameras mounted on a 16-ft boom attached to a helicopter. Further development of this technique should be the use of cameras with between-the-lens shutters and could include twin-camera photography from fixed-wing aircraft with cameras mounted in the wings. V.L.

**A80-20195 #** **Calculation of the spectral irradiance in spaceborne photography of the earth (K raschetu spektral'noi osveshchennosti pri fotografirovanii zemli iz kosmosa).** Iu. V, Krylov. *Geodeziia i Kartografiia,* Oct. 1979, p. 12-14. 8 refs. In Russian.

A method is proposed for calculating the spectral irradiance of the entrance pupil of an earth surveying camera. For illustration, the method is applied to calculations for the photography of various types of soil. V.P.

**A80-20238** **Analysis of plant community structure and successional stage using multispectral and multidate aerial photography.** R. R. Anderson, D. McFaden (American University, Washington, D.C.), and R. J. Kramer (Howard, Needles, Tammen, and Bergendoff, Alexandria, Va.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 1-9. 8 refs.

Vegetation community patterns were determined in Rock Creek Park from a combination of several types of aerial photography. No single date of photography provided the total picture because an eastern deciduous forest is a dynamic multilayered mixture of plant species. Natural differences in plant types, such as spring and fall foliage characteristics, and natural relationships, such as the affinity of a plant association for wet soils or exposed slopes were exploited by selecting the appropriate type of photography (color infrared, black-and-white, etc.) and the proper season coverage. A large part of the initial efforts were directed toward determining which combination of film and season was most useful for discriminating the various vegetation communities and their component layers. V.P.

**A80-20248** **A comparison of Landsat and forest survey estimates of forest cover.** R. M. Hoffer, S. C. Noyer, and R. P. Mroczynski (Purdue University, West Lafayette, Ind.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 221-231. 8 refs.

This study was conducted to compare estimates of forest acreages obtained by standard Forest Service procedures to estimates obtained through the application of computer-aided analysis techniques to Landsat data. A total of 158 counties in four states (Mich., Wis., N.Y., and Mo.) involving all or parts of 16 U.S.F.S. Survey Units were involved in the comparison. The results indicate that reasonably comparable acreage estimates can be obtained from the Landsat data, providing that proper analysis procedures are utilized. (Author)

**A80-20249 *** **Spectral vegetation relationships in a tropical rain forest.** B. N. Holben and C. T. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 249-263. 7 refs.

Jordan's (1969) spectral method of leaf-area index determination from measurements of the transmitted light at the forest floor is evaluated under a wide variety of illumination conditions in the Luquillo Rain Forest of Puerto Rico, using a hand-held radiometer. Previously suggested 'correction factors' for temporal adjustment were found to degrade the data. Quantitative use of the method was found to be restricted to high sun periods. Data collected under uniformly overcast conditions were of greater stability than under clear skies, however, stability was impaired by changes in cloud thickness. Care must be taken to minimize irradiational variability and to adquately sample the spatial variability. V.P.

**A80-20254** **Spectral classification of tomato disease severity levels.** L. D. Lathrop and S. P. Pennypacker (Pennsylvania State University, University Park, Pa.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 329-342. 10 refs.

Spectral reflectance measurements over the 380-800 nm region in 10 nm bandwidths were made of randomly sampled plants in a

0.4-ha block of determinant-growth tomatoes having the early blight disease in various severity levels. The relative significance among the forty three 10 nm bands and the severity levels of defoliation was determined by ordinary least-square regression. Two spectral regions of strong statistical significance - 380-510 and 600-690 nm - were identified and subsequently integrated to simulate two broad bandwidths. These bandwidths were used separately and in combination to compare several discriminant functions with respect to the classification of various severity levels of defoliation. V.P.

**A80-20257** **Mapping vegetation with low cover density from Landsat data.** R. M. McCoy and R. G. Witt (Utah, University, Salt Lake City, Utah). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 379-385.

An investigation is made into the problems of mapping vegetation having low cover densities in arid environments. Three study sites in central Utah having different vegetation cover ranging from low to medium densities are described. Results of mapping with a definition of bare ground extending up to 20% cover show improvement of other classes. Band ratios (R 5, 6 and R 5, 7) show capability for good estimates of cover density. (Author)

**N80-10588#** New Mexico Univ., Albuquerque. Technology Application Center.

**REMOTE SENSING APPLIED TO AGRICULTURAL RESOURCES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jun. 1979**

Gerald F. Zollars Jul. 1979 48 p

(NTIS/PS-79/0733/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 02D

This bibliography cites 193 articles from the international literature concerning remote sensing applications in the agricultural sector. The use of remote sensors for soil and vegetation mapping, soil moisture mapping, and the interpretation of agricultural land use is stressed. GRA

**N80-10994#** Joint Publications Research Service, Arlington, Va.

**LODGING OF GRAIN CROPS AND ITS DETECTION BY AERIAL PHOTOGRAPHY**

V. Ye. Budanov (All-Union Scientific Res. Inst. of Cybernetics) *In its* USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 1-6 Transl. into ENGLISH from Zashchita Rasteniy (Moscow), no. 4, 1979 p 32-33

Copyright. Avail: NTIS HC A06/MF A01

It was found that in several basic areas of grain production (northern Caucasus, nonchernozem areas, Kazakhstan, Ukraine, Belorussia and others) fermentative mycotic exhaustion especially increases under the influence of rainy weather, incessant dews and fogs. Investigations begun in various areas of the country in 1973 have made it possible to determine the basic features of the complicated biological mechanism causing the appearance, development and occurrence of the described phenomenon. The pathologic process occurs and develops under a certain combination of external and internal factors coming through successively and consists of the two following stages. The first stage is noninfectious and occurs during the phase of milk, wax and, less frequently, full ripeness of grain when the ears are moistened by rain, fog or continuous dews (with irrigated crops, during late watering when the grain is being formed). The second stage is infectious and is caused by saprophyte and semi-parasitic fungi from the genera of Alternaria, Cladosporium, Helminthosporium, Fusarium, etc. F.O.S.

**N80-12495** Landeskulturamt Hessen, Wiesbaden (West Germany).

**CLASSIFICATION OF AGRICULTURAL LAND WITH THE AID OF REMOTE SENSING METHODS [KLASSIFIZIERUNG AGRARISCHER LANDNUTZUNG MIT HILFE VON FERNERKUNDUNGSMETHODEN]**

P. Richtscheid *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 281-286 In GERMAN

Avail: Issuing Activity

Visual images of exploited land in the Rhein-Main region and around Wetterou were recorded and compared with scanning data and various photographs. Data obtained from flights in 1976 and May 1977 are interpreted. In spite of the unfavorable vegetation development periods during which data were recorded, it was possible to distinguish between different types of culture with the aid of the DIBIAS system. It is suggested that flights should either be more accurately synchronized with agricultural development phases, or that a program of regular flights should be set up. Author (ESA)

**N80-12496** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

**AERIAL PHOTOGRAPHY OF AGRICULTURAL FARMING LAND [UNTERSUCHUNG VON LUFTBILDERN LANDWIRTSCHAFTLICHER KULTUREN]**

H. Helbig *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 287-294 In GERMAN

Avail: Issuing Activity

Work conducted in the framework of a program for the recognition and determination of plant protection procedures and manure effects is described. Land divided into 2 x 5 sq m plots was studied. Various photographic conditions and vignetting effects made interpretation difficult. A procedure was developed to correct such effects, which relies on information contained in the image itself, and does not require any further measurement data. Author (ESA)

**N80-12497** Badische Anilin- und Soda-Fabrik A.G., Landwirtschaftliche, Giessen (West Germany).

**FEASIBILITY OF USING REMOTE SENSING FOR DETERMINING NUTRITIONAL REQUIREMENTS, DISEASES AND PST INFESTATIONS IN AGRICULTURAL CROPS [MOEGLICHKEITEN DER FERNERKUNDUNG ZUR BESTIMMUNG VON NAEHRSTOFFVERSORGUNG, KRANK-HEITS- UND SCHAEDLINGSBEFALL AN LANDWIRTSCHAFTLICHEN KULTUREN]**

K. H. Schneider *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 295-305 refs In GERMAN

Avail: Issuing Activity

The radiobiological behavior of crops in the IR and visible spectrum was studied. It is shown that measurements made during the 1976 summer FMP program are satisfactory for classifying different types of culture. Concrete examples with various crops are presented and examined. The biological processes taking place are considered. In one case, it was possible to distinguish between different varieties of oats. It was, however, not possible to determine nutrition requirements for the dry 1976 summer. It was possible, though, in one instance, to detect pest infestation in winter corn. The results obtained indicate that optimum information is acquired from low altitude vertical flights. The data obtained must be processed quickly. Author (ESA)

**N80-12498** Freiburg Univ. (West Germany).

**TEXTURE ANALYSIS AS A RECOGNITION PARAMETER FOR DIFFERENT TYPES OF FORESTS [ANALYSE DER TEXTUR ALS ERKENNUNGSPARAMETER ZUR IDENTIFIZIERUNG VON WALDTYPEN]**

S. A. Masumy and G. Hilderbrandt *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 307-317 refs In GERMAN

Avail: Issuing Activity

It is shown that quantitative and qualitative determinations of forest characteristics from textures are highly dependent on the sensors used and the aircraft altitudes, and at low altitudes, on the position within the image. Examples are given of results obtained using photographic and scanning techniques at varied heights with different forests. Similarities are observed between the values of defined texture parameters determined at given heights with these two techniques. Author (ESA)

**N80-12499** Freiburg Univ. (West Germany).
**PHENOLOGY AS A FACTOR IN THE DETERMINATION OF DIFFERENT FORMS IN VEGETATION BY REMOTE SENSING [PHAENOLOGIE ALS EINFLUSSGROESSE FUER DIE FERNERKUNDUNG VERSCHIEDENER VEGETATIONSFORMEN]**
H.-J. Doefel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 319-330 refs In GERMAN

Avail: Issuing Activity
Temporal and spatial variations in vegetation forms were studied. Microdensitometer profile measurements were performed on images obtained by photographic methods, and different emulsions were tested. Specific phenological characteristics were revealed in forest and agricultural zones. Methods are suggested for recording and processing the corresponding information so as to optimize the differentiation between different forms of vegetation. Author (ESA)

**N80-12500-** Freiburg Uniy. (West Germany).
**APPLICABILITY OF MULTISCANNING TECHNIQUES IN ESTABLISHING INVENTORIES FOR AGRICULTURAL FARMING AND FORESTRY [EINSATZMOEGLICHKEITEN DES MULTISPEKTRALSCANNERS FUER LAND- UND FORSTWIRTSCHAFTLICHE INVENTUREN]**
P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 331-344 refs In GERMAN

Avail: Issuing Activity
Multiscanning results obtained with a preselected test region are presented. Computerized maximum likelihood and minimum distance methods (DIBIAS system) permit the identification and classification of different crops and types of forest together with the regions over which they extend. The problems encountered and the factors to be taken into consideration are discussed. Author (ESA)

**N80-12501** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
**WHAT ARE THE ADVANTAGES OF MULTISPECTRAL CLASSIFICATION? [WAS BRINGT DIE MULTISPEKTRALE KLASSIFIZIERUNG?]**
E. Triendl *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 345-350 refs In GERMAN

Avail: Issuing Activity
Multispectral methods for classifying different crops are compared with classical procedures. The introduction of an ellipsoidal probability distribution enables a critical parametric function to be obtained from mean values and the covariance matrix (maximum likelihood classification). A practical example (bend in the Main, near Frankfort) with two scanning channels is studied. It is concluded that reliability and applicability could be enhanced by combining multispectral methods with local parameters. Author (ESA)

**N80-12512** Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
**ON THE SIGNIFICANCE OF SPECTRAL SIGNATURES OF VEGETATION COVERED SURFACES IN THE 400-1100 NANOMETER REGION [ZUR SIGNIFIKANZ VON SPEKTRALEN SIGNATUREN BEWACHSENER OBERFLAECHEN IM BEREICHT 400-110 NANOMETER]**
W. Fischer *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 427-437 refs In GERMAN

Avail: Issuing Activity
The effect of the sun zenith and sun azimuth angles on the spectral reflection factors of fodder beet, corn and other crops is investigated using measurements from a spectroradiometer. Overall radiation effects and variations with time of day and seasonal advances were studied. Results obtained, primarily in the Gottenheim region, are presented as a series of curves. The optical directional, and morphological reasons behind the observed variations are discussed. Author (ESA)

**N80-12513** Freiburg Univ. (West Germany).
**SPECTRAL REFLECTION FROM AGRICULTURAL AND FOREST REGIONS DURING THE VEGETATION PERIOD [SPEKTRALE REFLEXION LAND- UND FORSTWIRTSCHAFTLICHER KULTUREN WAEHREND DER VEGETATIONSPERIODE]**
A. Kadro *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 439-448 refs In GERMAN

Avail: Issuing Activity
Reflection measurements made in the 400 to 1100 nm region with a radiometer are discussed. The highly maneuverable apparatus developed to maintain the radiometer at a height of 17 meters while allowing measurements to be carried out at various angles is described. Investigations, performed on different dates, established typical qualitative and quantitive differences between reflection factor curves corresponding to the different regions studied. Author (ESA)

**N80-12523*#** Commission of the European Communities, Ispra (Italy).
**SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979**
31 Aug. 1979 50 p refs Sponsored by NASA ERTS
(E80-10007; NASA-CR-162384; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

**N80-12525*#** Commission of the European Communities, Ispra (Italy).
**JOINT FLIGHT EXPERIMENT UK/1977. REPORT NO. 1: PLANNING AND EXECUTION**
P. Reiniger, Principal Investigator Feb. 1977 22 p Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10022; NASA-CR-162394) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-12526*#** Commission of the European Communities, Ispra (Italy).
**TELLUS: A COMBINED SURFACE TEMPERATURE, SOIL MOISTURE AND EVAPORATION MAPPING APPROACH**
A. Rosema (EARS, Delft, Netherlands), J. H. Bijleveld (EARS, Delft, Netherlands), P. Reiniger, G. Tassone, K. Blyth (Inst. of Hydrology, Wallingford, England), and R. J. Gurney, Principal Investigators (Inst. of Hydrology, Wallingford, England) 1978 11 p refs Presented at 12th Intern. Symp. on Remote Sensing of Environment, 20-26 Apr. 1978; sponsored by ERIM, Natural Resources Management Center, Philippines, Michigan Univ., AID, Geological Survey, Dept. of Agriculture, NASA, DOE, FHA, Dept. of Interior, DOT, NOAA, TVA, GE Co., Daedalus Enterprises, Inc., Bendix Corp., Taiwan Forestry Bureau and NAC, Inc., Tokyo Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10023; NASA-CR-162395) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-12528*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Apr. - 30 Jun. 1979**
R. P. Mroczynski, Principal Investigator 30 Jun. 1979 29 p EREP
(Contract NAS9-15325)
(E80-10026; NASA-CR-160346; LARS-063079) Avail: NTIS HC A03/MF A01 CSCL 02F

**N80-12529*#** Environmental Research Inst. of Michigan, Ann Arbor.

**A STUDY OF THE TOLERANCE BLOCK APPROACH TO SPECIAL STRATIFICATION Technical Report, 15 Dec. 1978 - 15 Jun. 1979**

W. Richardson, Principal Investigator Aug. 1979 60 p refs EREP

(Contract NAS9-15476)

(E80-10027; NASA-CR-160351; ERIM-132400-25-R) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Twelve winter wheat LACIE segments in Kansas were used to compare the performance of three clustering methods: (1) BCLUST, which uses a spectral distance function to accumulate clusters; (2) blocks-alone, which divides spectral space into equally populated blocks; and (3) block-seeds, which uses spectral means of blocks-alone as seeds for accumulating distance-type clusters. Both BCLUST and block-seeds performed equally well and outperformed blocks-alone significantly. Their average variance ratio of about 0.5 showed imperfect separation of wheat from non-wheat. This result points to the need to explore the achievable crop separability in the spectral/temporal domain, and suggest evaluating derived features rather than data channels as a means to achieve purer spectral strata.

**N80-12531*#** Commission of the European Communities, Ispra (Italy).

**TELLUS NEWSLETTER 1**

P. Reiniger, Principal Investigator Oct. 1978 8 p In ENGLISH and FRENCH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Proj. TELLUS)

(E80-10029; NASA-CR-162397) Avail: NTIS HC A02/MF A01 CSCL 08F

**N80-12532*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**THE RELATIONSHIP OF RED AND PHOTOGRAPHIC INFRARED SPECTRAL DATA TO GRAIN YIELD VARIATION WITHIN A WINTER WHEAT FIELD**

C. J. Tucker, Brent N. Holben, James H. Elgin, Jr. (Beltsville Agricultural Res. Center, Md.), and James E. McMurtrey, III (Beltsville Agricultural Res. Center, Md.) Jul. 1979 28 p refs Submitted for publication

(NASA-TM-80328) Avail: NTIS HC A03/MF A01 CSCL 02C

Two band hand-held radiometer data from a winter wheat field, collected on 21 dates during the spring growing season, were correlated within field final grain yield. Significant linear relationships were found between various combinations of the red and photographic infrared radiance data collected and the grain yield. The spectral data explained approximately 64 percent of the within field grain yield variation. This variation in grain yield could not be explained using meteorological data as these were similar for all areas of the wheat field. Most importantly, data collected early in the spring were highly correlated with grain yield, a five week time window existed from stem elongation through antheses in which the spectral data were most highly correlated with grain yield, and manifestations of wheat canopy water stress were readily apparent in the spectral data. Author

**N80-13588*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Apr. - 15 Jul. 1979**

Roger M. Hoffer, Principal Investigator Jul. 1979 8 p EREP

(Contract NAS9-15508)

(E80-10009; NASA-CR-160312; LARS-071579) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-13589*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EXPERIMENT PLAN FOR EVALUATION OF LANDSAT AGRONOMIC VARIABLES USING WHEAT INTENSIVE TEST SITES**

D. E. Phinney, Principal Investigator Aug. 1979 27 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10010; NASA-CR-160315; JSC-16020; LEC-13632) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-13590*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THE LACIE TRANSITION YEAR CROP CALENDAR MODEL**

R. E. Cheffin and S. K. Woolley, Principal Investigators Jul. 1979 22 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10011; NASA-CR-160314; JSC-16019; LEC-13482) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The estimates of developmental stage dates from the LACIE adjustable crop calendar (ACC) winter wheat model was somewhat more accurate than the historical crop calendar after jointing. The ACC winter wheat model was not so accurate for the Texas Panhandle as it was for the other areas of the USPG-7 because dry soil conditions delayed fall planting in the Panhandle. Since the LACIE ACC winter wheat model does not contain a moisture term and it was started with historical planting dates, lengthy delays in planting mean that the ACC model will probably be started early and will estimate the developmental growth stages to occur too early in the season. The LACIE ACC spring wheat model was also started early in most areas because of late planting due to fields wet from melting snow and rain. The starter model used to estimate spring planting dates was not accurate under these wet soil conditions and tended to predict the developmental stages to occur earlier than the dates observed in the fields.

**N80-13591*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LIST SPECTRAL KEYS STUDY**

T. B. Dennis and M. D. Pore, Principal Investigators Aug. 1979 19 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10012; NASA-CR-160338; JSC-15042; LEC-13456) Avail: NTIS HC A02/MF A01 CSCL 08F

**N80-13593*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 DIRECT WHEAT STUDY OF NORTH DAKOTA**

M. C. Kinsler, J. D. Nichols, and A. L. Ona, Principal Investigators Apr. 1979 158 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10014; NASA-CR-160340; JSC-14744; LEC-12980) Avail: NTIS HC A08/MF A01 CSCL 02C

The author has identified the following significant results. The green number and brightness scatter plots, channel plots of radiance values, and visual study of the imagery indicate separability between barley and spring wheat/oats during the wheat mid-heading to mid-ripe stages. In the LACIE Phase 3 North Dakota data set, the separation time is more specifically the wheat soft dough stage. At this time, the barley is ripening, and is therefore, less green and brighter than the wheat. Only 4 of the 18 segments studied indicate separation of barley/other spring small grain, even though 11 of the segments have acquisitions covering the wheat soft dough stage. The remaining seven segments had less than 5 percent barley based on ground truth data.

**N80-13594*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 LABELING ERROR CHARACTERIZATION Final Report**
N. James Clinton, Principal Investigator Mar. 1979 77 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10015; NASA-CR-160341; JSC-14745; LEC-13012) Avail: NTIS HC A05/MF A01 CSCL 02C

**N80-13595*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). A REVISED SCREENING PROCEDURE FOR LACIE PHASE 3 DATA IN THE US GREAT PLAINS**
R. S. Chhikara, Principal Investigator Aug. 1979 9 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E80-10016; NASA-CR-160313; JSC-14852; LEC-12723) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The screening procedure resulted in a substantial decrease in the official LACIE winter acreage estimate, bringing the two estimates into better agreement with corresponding USDA/ESCS estimates.

**N80-13597*#** Institut National de la Recherche Agronomique, Paris (France).
**ESTIMATES OF REGIONAL ET FROM HCMM DATA: SUMMARY OF 1977 EXPERIMENT AND FINAL ARRANGEMENT FOR 1978 IN SOUTHEASTERN FRANCE TEST SITE**
Bernard Seguin, Principal Investigator [1979] 29 p refs Sponsored by NASA ERTS
(E80-10018; NASA-CR-162390) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-13598*#** Commission of the European Communities, Ispra (Italy).
**SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979**
1978 50 p refs Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10019; NASA-CR-162391; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

**N80-13599*#** Institute of Hydrology, Wallingford (England).
**THE ESTIMATION OF SOIL MOISTURE CONTENT AND ACTUAL EVAPOTRANSPIRATION USING THERMAL INFRA-RED REMOTE SENSING**
R. J. Gurney, Principal Investigator 1978 20 p refs Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10021; NASA-CR-162393) Avail: NTIS HC A02/MF A01 CSCL 08M

**N80-13600*#** Commission of the European Communities, Ispra (Italy).
**BEAUCE TELLUS PROJECT [CAMPAGUE TELLUS BEAUCE]**
30 Sep. 1977 21 p In FRENCH Sponsored by NASA ERTS
(E80-10024; NASA-CR-162396) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-13616#** Instituut voor Culturrtechniek en Waterhuishouding, Wageningen (Netherlands).
**ESTIMATION OF REGIONAL EVAPOTRANSPIRATION AND SOIL MOISTURE CONDITIONS USING REMOTELY SENSED CROP SURFACE TEMPERATURES**
G. J. R. Soer Sep. 1977 31 p refs
(Rept-1003) Avail: NTIS HC A03/MF A01

The application of thermal infrared scanning to the measurement of aerial heat and water budgets of crop lands is considered. Emphasis is placed on obtaining regional evapotranspiration estimates, making water balance analyses for large areas more feasible. Also, crop production as correlated with the actual crop transpiration rate can be estimated. J.M.S.

**N80-14424** State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
**THE MAPPING OF IMPORTANT FARMLAND USING REMOTE SENSOR AND SOCIO-ECONOMIC VARIABLES Ph.D. Thesis**
Jon Laurence Roberts 1979 233 p
Avail: Univ. Microfilms Order No. 7920317

A comprehensive digital data base of physical (land use) and socio-economic (zoning, agricultural districts, rental/ownership patterns) factors important to farming was created. LANDSAT land use data was collected over the Ontario County, New York study area and grouped into agriculture and forest classes. The socio-economic data was converted to an image-based format by causing the outlines of zones and districts to be digitized and filled in with pixels of a certain grey level. These images are then stored to create the data base. An accuracy check was made on the LANDSAT data using a color infrared U-2 image of the study area. A spectral land use classification was also performed using digitized U-2 data. LANDSAT classification accuracy is 64% correct for the forest class. U-2 classification accuracy is 82% correct for the forest class. Dissert. Abstr.

**N80-14425#** Forest Service, Washington, D. C.
**FORESTER'S GUIDE TO AERIAL PHOTO INTERPRETATION Agriculture Handbook no. 308**
Thomas Eugene Avery Nov. 1978 47 p refs
Avail: NTIS HC A03/MF A01

A practical reference on techniques of aerial photo interpretation in forest inventory is provided. While oblique photographs are occasionally useful for interpretation, this manual emphasizes stereoscopic interpretation of vertical aerial photographs available from various agencies of the U.S. Department of Agriculture. A.R.H.

**N80-14440#** European Space Agency, Paris (France).
**SATELLITE REMOTE SENSING: APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY**
Eric C. Barrett, ed. (Bristol Univ.) 1979 177 p refs Proc. of lectures of Joint ESA/Food and Agr. of UN/WMO Intern. Training Course, Rome, 2-13 Oct. 1978
(ESA-SP-1020; ISSN-0379-6566) Avail: NTIS HC A09/MF A01

The principles and potentials of satellite remote sensing as applied to agroclimatological and agrometeorological techniques are considered. Major subjects of discussion include the theory behind remote sensing instrumentation and the interpretation of satellite observations. Various remote sensing programs are covered, such as the Earthnet program and the Agro-Ecological Zones Project. Also presented are numerous mathematical models which can be readily used with inputs of satellite imagery data.

**N80-14441#** Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Production and Protection Div.
**OVERVIEW OF AGROMETEOROLOGY**

Michel Frere *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 3-7

Avail: NTIS HC A09/MF A01

Agrometeorology, a branch of science which aims at using meteorological information to develop quantitatively and improve qualitatively the products of agriculture by taking maximum advantage of the favorable aspects of climate and minimizing the harmful effects of weather, is reviewed. Strategic aspects of agrometeorology, affecting long term planning of agriculture when envisaging agricultural projects or crop diversification in a given area, are considered. Tactical aspects of agrometeorology, concerning the short term influences of day to day weather on the development of crops and the evolution of their yield, are also discussed. Emphasis is placed on the interdisciplinary aspect of agrometeorology. Author (ESA)

**N80-14442#** Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

**OVERVIEW OF REMOTE SENSING FOR AGRICLIMATOLOGY AND AGROMETEOROLOGY**

John A. Howard *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 8-13

Avail: NTIS HC A09/MF A01

The evolution of civilian applications of satellite remote sensing is reviewed. Emphasis is on the greater availability of sensing equipment and the application of more readily obtainable data to agrometeorology as well as to agroclimatology. A forward look into the development of satellite remote sensing is offered, considering Earth resources satellites and environmental satellites. It is shown that good data on land surfaces, ocean surfaces, clouds, and atmospheric composition are now at the disposition of researchers and that emphasis should be placed on improving the quality and uniformity of these data. Author (ESA)

**N80-14445#** Food and Agriculture Organization of the United Nations, Rome (Italy).

**THE AGRO-ECOLOGICAL ZONES PROJECT**

A. H. Kassam IN ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 32-33 refs

Avail: NTIS HC A09/MF A01

An estimate is made of what the production of the world's arable lands must be to support the world population in the year 2000. Different crops with widely varying climatic and soil requirements as well as different levels of agricultural technology are reviewed in order to assess the real world food production potential. The eleven crops considered are pearl millet, sorghum, maize, rice, wheat, phaseolus bean, soybean, cassava, sweet potato, white potato, and cotton. Results include a generalized map of agroclimatic suitability for the various crops and a land suitability assessment. Author (ESA)

**N80-14446#** Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

**REMOTE SENSING APPLIED TO AGRICULTURE**

J. A. Howard IN ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 36-42 ref

Avail: NTIS HC A09/MF A01

The ways in which remote sensing can be used to assist in providing information useful to food production are considered. In this respect remote sensing for agricultural crop estimates is seen as one of the most important inputs. The diagnostic characteristics used in analying remote sensing imagery, whether airborne or obtained by an Earth resources satellite, are discussed. They are summarized according to the type of sensing being undertaken. The formulation of agricultural crop estimates is then shown. Author (ESA)

**N80-14447#** Environmental Analysis and Remote Sensing, Delft (Netherlands).

**THE APPLICATION OF THERMAL INFRARED REMOTE SENSING DATA TO SOIL MOISTURE AND EVAPORTATION DETERMINATION**

I. A. Rosema *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 46-59 refs

Avail: NTIS HC A09/MF A01

The time and weather conditions that favor the extraction of information on soil moisture and evaporation from thermal imagery are discussed. Mathematical models of the relations in question are presented along with an algorithm for the interpretation of remotely sensed surface temperature imagery. Fields of application and the need for ground truth data are discussed. Application of the algorithm to crop irrigation is discussed. J.M.S.

**N80-14450#** Land Resource Research Inst., Ottawa (Ontario).

**CROP WEATHER MODELS: CONCEPTS AND APPLICATIONS**

W. Baier *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 88-93 refs

Avail: NTIS HC A09/MF A01

Various crop-weather analysis models are presented in order to illustrate the role of agrometeorology in scientific crop development. Those models presented include factorial yield models, empirical statistical yield models, and associated sub-models used in crop growth simulation studies. The separation of technological change from meteorological variability is then treated. An example showing time trends and weather variables in a multiple curvilinear regression analysis performed on data taken on the state of Illinois is cited. Finally, possible applications of crop-weather models are briefly assessed. Author (ESA)

**N80-14451#** Joint Research Centre of the European Communities, Ispra (Italy).

**AGROCLIMATOLOGICAL METHODS INVOLVING REMOTE SENSING TECHNIQUES**

G. Fraysse *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 94-115 refs

Avail: NTIS HC A09/MF A01

The application of remote sensing techniques to agrometeorology and crop monitoring is considered with emphasis on improving the agricultural productivity of developing countries. The data requirements for crop monitoring and yield forecasting models are discussed. The performance of Earth observation satellites and the advantages of the data collecting systems of the satellites are given. J.M.S.

**N80-14452#** Bristol Univ. (England). Climatology and Remote Sensing.

**CROP ENVIRONMENT MONITORING: THE REMOTE SENSING SYSTEMS**

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 116-120 refs

Avail: NTIS HC A09/MF A01

Aircraft and LANDSAT imagery are evaluated for their usefulness in environmental monitoring programs. The favorable and unfavorable characteristics of weather satellite operations in this application are then outlined. A list of weather satellite systems which could contribute to crop environment monitoring is also given. Finally, the participation of weather satellites in international and national monitoring programs is reviewed. Author (ESA)

**N80-14454#** Bristol Univ. (England). Climatology and Remote Sensing.

**CROP ENVIRONMENT MONITORING: THE ASSESSMENT OF ENVIRONMENTAL PHENOMENA USING SATELLITE REMOTE SENSING DATA**

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 127-142 refs

Avail: NTIS HC A09/MF A01

The extension of agrometeorological statistics through the use of satellite data is examined. The environmental parameters or phenomena considered, ranked after the present utility and/or

practicality of satellite remote sensing as an aid in their assessment, are: (1) rainfall, (2) temperature, (3) weather type and variability, and (4) cloud cover (radiation balance). For convenience, a differentiation is made between the atmospheric and pedologic environments of crops. In the first case the emphasis is on the utilization of weather satellite data for the extension of selected conventional meteorological statistics, the available in situ data are used as air or ground truth for the preparation, in effect, of meteorological trend surfaces upon which detail may be embroidered from satellite observations after these have been compared with, and calibrated by, the conventional data. In the second case there is a similar association of conventional and satellite soil intelligence, though in this case techniques to interdigitate the two have been less fully developed.
Author (ESA)

**N80-14455#** Bristol Univ. (England). Climatology and Remote Sensing.
**CROP MONITORING AND PREDICTION USING SATELLITE DATA**
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 149-156 refs

Avail: NTIS HC A09/MF A01
Analysis techniques used in making estimates of biomass (usually of natural or seminatural vegetation, especially in areas exploited for grazing) and in forecasting expected crop production (usually cultivated cereal crops) are studied. The use of LANDSAT spectral reflectance curves as prediction model inputs is emphasized. The use of statistical methods, agroclimatological methods, agrometeorological methods with crop prediction models is then considered. Results show clear advantages in the use of satellite data inputs for the monitoring of crops and in making harvest predictions. It is recommended that global schemes, based on these results, be initiated at least for certain crops in the near future in order to optimize agricultural resources.
Author (ESA)

**N80-14456#** Bristol Univ. (England). Climatology and Remote Sensing.
**SATELLITE REMOTE SENSING IN HAZARD MONITORING AND DISASTER EVALUATION**
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 157-163 refs

Avail: NTIS HC A09/MF A01
The potential applicability of satellite remote sensing to short term disaster monitoring is discussed. Emphasis is on different types of agricultural disasters, such as drought, high-intensity short-period rainfall and subsequent flooding as well as hurricanes or monsoons. It is shown that remote sensing can also be of assistance in the assessment of the areas, and therefore, the volumes and values of the crops involved. Finally, the use of satellite data as a check against qualitative data from other sources, especially for countries with an inadequate conventional network for the observation and reporting of environmental conditions, is suggested.
Author (ESA)

**N80-14457#** Bristol Univ. (England). Climatology and Remote Sensing.
**SATELLITE REMOTE SENSING FOR AGRICULTURAL ADVISORIES AND PLANNING**
E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 164-165

Avail: NTIS HC A09/MF A01
How an input of remote sensing data might be achieved to improve agroclimatological and related services in the various countries which stand to benefit from this technology is considered. Problems which commonly arise in the face of the implementation of new technologies are discussed. In spite of the individuals and organizations which would be interested in remote sensing data (farmers, farming communities, commercial firms, political organizations, humanitarian agencies), significant problems are foreseen in the widespread acceptance of remote sensing technology.
Author (ESA)

**N80-15448*#** National Aeronautics and Space Administration Lyndon B. Johnson Space Center, Houston, Tex.
**PROCEEDINGS OF TECHNICAL SESSIONS, VOLUMES 1 AND 2: THE LACIE SYMPOSIUM**
Jul. 1979 1095 p refs Symp. held at Houston, Tex., 23-26 Oct. 1978 Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (E80-10030; NASA-TM-80811; JSC-16015-Vol-1; JSC-16015-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 02C
The technical design of the Large Area Crop Inventory Experiment is examined and data acquired over 3 global crop years is analyzed with respect to (1) sampling and aggregation; (2) growth size estimation; (3) classification and mensuration; (4) yield estimation; and (5) accuracy assessment. Seventy-nine papers delivered at conference sessions cover system implementation and operation; data processing systems; experiment results and accuracy; supporting research and technology; and the USDA application test system.

**N80-15449*#** National Aeronautics and Space Administration Lyndon B. Johnson Space Center, Houston, Tex.
**SAMPLING, AGGREGATION, AND VARIANCE ESTIMATION FOR AREA, YIELD, AND PRODUCTION IN LACIE**
C. R. Hallum, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), A. H. Feiveson, and A. G. Houston, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 3-18 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C
An approximately 2% sampling error was achieved in LACIE by sampling only approximately 2% of the sampling frame. The sample design in the yardstick region for which historical data were available down to a substratum level to support missing data resulting from cloud cover provided the most accurate estimate possible. The implemented strategy provided data of sufficient quality and quantity to support required performance levels and also to satisfy the existing constraints. The allocation scheme appeared to provide the most efficient usage of the available data and gave segment coverage of major producing areas and thus improved the probability of an accurate estimate.
Author

**N80-15450*#** Department of Agriculture, Columbia, Md.
**ECONOMETRIC MODELS FOR PREDICTING CONFUSION CROP RATIOS**
D. E. Umberger, M. H. Proctor, J. E. Clark (Oregon State Univ., Corvallis), L. M. Eisgruber (Oregon State Univ., Corvallis), and C. B. Braschler, Principal Investigators (Missouri Univ., Columbia) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 19-46 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
Results for both the United States and Canada show that econometric models can provide estimates of confusion crop ratios that are more accurate than historical ratios. Whether these models can support the LACIE 90/90 accuracy criterion is uncertain. In the United States, experimenting with additional model formulations could provide improved methods models in some CRD's, particularly in winter wheat. Improved models may also be possible for the Canadian CD's. The more aggressive province/state models outperformed individual CD/CRD models. This result was expected partly because acreage statistics are based on sampling procedures, and the sampling precision declines from the province/state to the CD/CRD level. Declining sampling precision and the need to substitute province/state data for the CD/CRD data introduced measurement error into the CD/CRD models.
A.R.H.

**N80-15451*#** National Aeronautics and Space Administration Lyndon B. Johnson Space Center, Houston, Tex.
**LACIE SAMPLING DESIGN**
A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and C. R. Hallum, Principal Investigators *In its* Proc. of

Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 47-52 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The sampling design in LACIE consisted of two major components, one for wheat acreage estimation and one for wheat yield prediction. The acreage design was basically a classical survey for which the sampling unit was a 5- by 6-nautical mile segment; however, there were complications caused by measurement errors and loss of data. Yield was predicted by sampling meteorological data from weather stations within a region and then using those data as input to previously fitted regression equations. Wheat production was not estimated directly, but was computed by multiplying yield and acreage estimates. The allocation of samples to countries is discussed as well as the allocation and selection of segments in strata/substrata. A.R.H.

**N80-15452*#** Lockheed Electronics Co., Houston, Tex.
**LACIE AREA SAMPLING FRAME AND SAMPLE SELECTION**
C. J. Liszcz, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 53-56 ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

Transparent acetate overlays containing agricultural boundaries within each of the LACIE countries were prepared and registered to operational navigation charts (ONC's). Full frame LANDSAT color-infrared images of the same scale as the ONC's (1:1 million) were used to identify agricultural boundaries based on discernible agricultural field patterns. Preliminary steps taken in the preparation of the base map overlay, and the construction of an overlay of the base map physical features are described as well as the construction of the agricultural and nonagricultural delineation overlay. A.R.H.

**N80-15453*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LACIE LARGE AREA ACREAGE ESTIMATION**
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 57-65 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A sample wheat acreage for a large area is obtained by multiplying its small grains acreage estimate as computed by the classification and mensuration subsystem by the best available ratio of wheat to small grains acreages obtained from historical data. In the United States, as in other countries with detailed historical data, an additional level of aggregation was required because sample allocation was made at the substratum level. The essential features of the estimation procedure for LACIE countries are included along with procedures for estimating wheat acreage in the United States. A.R.H.

**N80-15454*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LARGE AREA AGGREGATION AND MEAN-SQUARED PREDICTION ERROR ESTIMATION FOR LACIE YIELD AND PRODUCTION FORECASTS**
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 67-71 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Aggregation formulas are given for production estimation of a crop type for a zone, a region, and a country, and methods for estimating yield prediction errors for the three areas are described. A procedure is included for obtaining a combined yield prediction and its mean-squared error estimate for a mixed wheat pseudozone. A.R.H.

**N80-15455*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**CLASSIFICATION AND MENSURATION OF LACIE SEGMENTS**
R. P. Heydorn, R. M. Bizzell, J. A. Quirein (Lockheed Electronics Co., Houston, Tex.), K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.), and C. A. Sumner, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 73-86 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The theory of classification methods and the functional steps in the manual training process used in the three phases of LACIE are discussed. The major problems that arose in using a procedure for manually training a classifier and a method of machine classification are discussed to reveal the motivation that led to a redesign for the third LACIE phase. A.R.H.

**N80-15456*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LACIE REGISTRATION PROCESSING**
Gerald J. Grebowsky, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 87-97 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform correlations to ensure registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges. A.R.H.

**N80-15457*#** Environmental Data and Information Service, Washington, D. C.
**DEVELOPMENT OF LACIE CCEA-1 WEATHER/WHEAT YIELD MODELS**
N. D. Strommen, C. M. Sakamoto (Environmental Data and Information Service, Columbia, Mo.), S. K. LeDuc (Environmental Data and Information Service, Columbia, Mo.), and D. E. Umberger, Principal Investigators (USDA Economics, Statistics, and Cooperative Service, Columbia, Mo.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 99-108 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The advantages and disadvantages of the casual (phenological, dynamic, physiological), statistical regression, and analog approaches to modeling for grain yield are examined. Given LACIE's primary goal of estimating wheat production for the large areas of eight major wheat-growing regions, the statistical regression approach of correlating historical yield and climate data offered the Center for Climatic and Environmental Assessment the greatest potential return within the constraints of time and data sources. The basic equation for the first generation wheat-yield model is given. Topics discussed include truncation, trend variable, selection of weather variables, episodic events, strata selection, operational data flow, weighting, and model results. A.R.H.

**N80-15458*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**GROWTH STAGE ESTIMATION**
V. S. Whitehead, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and W. E. Crea, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 109-114 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three candidate approaches to adjustment of the crop calendar to account for year-to-year weather differences, the Robertson triquadratic unit, a function of a nonlinear function of maximum and minimum temperature and day length, best described the rate of phenological development of wheat. The adjustable crop calendar (ACC) as implemented for LACIE is used to calculate the daily increment of development through six physiological stages of growth. Topics covered include dormancy modeling, the spring restart model, spring wheat starter model, winter starter model, winter wheat starter model, inclusion of the moisture variable, and display of crop stage estimation results. Assessment of the ACC accuracy over the period of LACIE operation indicates that the adjustable crop calendars used provided more accurate information than would have been available using historical norms. The models performed best under the conditions from which they were derived (Canadian spring wheat) and most poorly for the dwarf varieties and Southern Hemisphere applications. A.R.H.

**N80-15459*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ACCURACY ASSESSMENT: THE STATISTICAL APPROACH TO PERFORMANCE EVALUATION IN LACIE**
A. G. Houston, A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and E. N. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 115-130 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A statistical methodology was developed to check the accuracy of the products of the experimental operations throughout crop growth and to determine whether the procedures are adequate to accomplish the desired accuracy and reliability goals. It has allowed the identification and isolation of key problems in wheat area yield estimation, some of which have been corrected and some of which remain to be resolved. The major unresolved problem in accuracy assessment is that of precisely estimating the bias of the LACIE production estimator. Topics covered include: (1) evaluation techniques; (2) variance and bias estimation for the wheat production estimate; (3) the 90/90 evaluation; (4) comparison of the LACIE estimate with reference standards; and (5) first and second order error source investigations. A.R.H.

**N80-15460*#** California Univ. at Berkeley.
**MANUAL INTERPRETATION OF LANDSAT DATA**
C. M. Hay, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 131-146 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The task of the analyst throughout LACIE phases 1 and 2 consisted of outlining representative areas (fields) for all spectral classes within a segment on the basis of their appearance on the LANDSAT image products, and then labeling the crop type (wheat/nonwheat) within the selected training areas. For LACIE phase 3, a procedure was developed and implemented which incorporated clustering for spectral class definition and training statistics generation. The only analyst's task was crop type identification. The logical processes involved in interpretation are described, rather than a step-by-step description of analyst procedures. A.R.H.

**N80-15461*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ACQUISITION AND PREPROCESSING OF LANDSAT DATA**
T. N. Horn (GE Space Div., Beltsville, Md.), L. E. Brown, and W. H. Anonsen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 147-155 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The original configuration of the GSFC data acquisition, preprocessing, and transmission subsystem, designed to provide LANDSAT data inputs to the LACIE system at JSC, is described. Enhancements made to support LANDSAT -2, and modifications for LANDSAT -3 are discussed. Registration performance throughout the 3 year period of LACIE operations satisfied the 1 pixel root-mean-square requirements established in 1974, with more than two of every three attempts at data registration proving successful, notwithstanding cosmetic faults or content inadequacies to which the process is inherently susceptible. The cloud/snow rejection rate experienced throughout the last 3 years has approached 50%, as expected in most LANDSAT data use situations. A.R.H.

**N80-15462*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ANCILLARY DATA ACQUISITION FOR LACIE**
B. E. Spiers (USDA Agricultural Stabilization and Conservation Service, Houston, Tex.) and R. L. Patterson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 157-162 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The design, implementation, and operational functions of the three phases of LACIE supported the data needs of all other elements of the project and required several types of data in addition to LANDSAT multispectral digital data. The nonelectronic data base consisted of statistical data, printed reports, periodicals, ground observed data received from intensive test sites and operational segments, and full-frame multispectral scanner CIR photographs. The following data were collected for the test sites in the United States and Canada: land use inventories, periodic crop observations, solar radiometer measurements, rainfall, and wheat yield for selected fields. A.R.H.

**N80-15463*#** Lockheed Electronics Co., Houston, Tex.
**LACIE DATA-HANDLING TECHNIQUES**
G. H. Waits, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 163-167 ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

Techniques implemented to facilitate processing of LANDSAT multispectral data between 1975 and 1978 are described. The data that were handled during the large area crop inventory experiment and the storage mechanisms used for the various types of data are defined. The overall data flow, from the placing of the LANDSAT orders through the actual analysis of the data set, is discussed. An overview is provided of the status and tracking system that was developed and of the data base maintenance and operational task. The archiving of the LACIE data is explained. Author

**N80-15464*#** Lockheed Electronics Co., Houston, Tex.
**THE ACQUISITION, STORAGE, AND DISSEMINATION OF LANDSAT AND OTHER LACIE SUPPORT DATA**
L. F. Abbotts and R. M. Nelson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 169-177 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Activities performed at the LACIE physical data library are described. These include the researching, acquisition, indexing, maintenance, distribution, tracking, and control of LACIE operational data and documents. Much of the data available can be incorporated into an Earth resources data base. Elements of the data collection that can support future remote sensing programs include: (1) the LANDSAT full-frame image files, (2) the microfilm file of aerial and space photographic and multispectral maps and charts that encompasses a large portion of the Earth's surface, (3) the map/chart collection that includes various scale maps and charts for a good portion of the U.S. and the LACIE area in foreign countries, (4) computer-compatible tapes of good quality LANDSAT scenes, (5) basic remote sensing data, project data, reference material, and associated publications, (6) visual aids to support presentation on remote sensing projects, and (7) research acquisition and handling procedures for managing data. A.R.H.

**N80-15465*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**THE CLASSIFICATION AND MENSURATION SUBSYSTEM**
K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.) and R. M. Bizzell, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 179-201 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

From an operational standpoint, the most significant item the classification and mensuration subsystem (CAMS) had to overcome in providing the acreage component of the wheat production estimates for LACIE was the scope (segment volume processing required). Peak processing requirements per day increased from 16 to 20 for phase 1 with 700 total segments, to 35 to 40 per day for phase 2 with 1700 total segments, to 75 to 80 per day for phase 3 with 3000 total segments. Key issues regarding interrelationships between man and machines were identified during phase 1 using first generation technology. Procedure 1, tested and evaluated during phase 2 and continued through the initial phase 3 processing period for winter wheat, showed the need for software modification, procedures development, and analyst training. CAMS operations are described with emphasis on the training backgrounds of the analysts, the available data, and the labeling logic. A.R.H.

**N80-15466*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

### CONCEPTS LEADING TO THE IMAGE-100 HYBRID INTERACTIVE SYSTEM

T. F. Mackin and J. M. Sulester, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 203-209 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

As LACIE Procedure 1 evolved from the Classification and Mensuration Subsystem smallfields procedures, it became evident that two computational systems would have merit-the LACIE/Earth Resources Interactive Processing System based on a large IBM-360 computer oriented for operational use with high computational throughput, and a smaller, highly interactive system based on a PDP 11-45 minicomputer and its display system, the IMAGE-100. The latter had advantages for certain phases, notably, interactive spectral aids could be implemented quite rapidly. This would allow testing and development of Procedure 1 before its implementation on the LACIE/Earth Resources Interactive Processing System. The resulting minicomputer system, called the Classification and Mensuration Subsystem IMAGE-100 Hybrid System, allowed Procedure-1 operations to be performed interactively, except for clustering, classification, and automatic selection of best acquisitions, which were offloaded to the LACIE/Earth Resources Interactive Processing System. Author

**N80-15467*#** Department of Agriculture, Houston, Tex.

### USDA ANALYST REVIEW OF THE LACIE IMAGE-100 HYBRID SYSTEM TEST

P. Ashburn, K. Buelow, H. L. Hansen (USDA Soil Conservation Service, Houston, Tex.), and G. A. May, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 211-215 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Fifty operational segments from the U.S.S.R., 40 test segments from Canada, and 24 test segments from the United States were used to provide a wide range of geographic conditions for USDA analysts during a test to determine the effectiveness of labeling single pixel training fields (dots) using Procedure 1 on the 1-100 hybrid system, and clustering and classifying on the Earth Resources Interactive Processing System. The analysts had additional on-line capabilities such as interactive dot labeling, class or cluster map overlay flickers, and flashing of all dots of equal spectral value. Results on the 1-100 hybrid system are described and analyst problems and recommendations are discussed. A.R.H.

**N80 15468*#** National Oceanic and Atmospheric Administration, Houston, Tex.

### OPERATION OF THE YIELD ESTIMATION SUBSYSTEM

D. G. McCrary, J. L. Rogers (USDA Federal Crop Insurance Corp., Houston, Tex.), and J. D. Hill, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 217-225 ERTS
N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The organization and products of the yield estimation subsystem (YES) are described with particular emphasis on meteorological data acquisition, yield estimation, crop calendars, weekly weather summaries, and project reports. During the three phases of LACIE, YES demonstrated that it is possible to use the flow of global meteorological data and provide valuable information regarding global wheat production. It was able to establish a capability to collect, in a timely manner, detailed weather data from all regions of the world, and to evaluate and convert that data into information appropriate to the project's needs. A.R.H.

**N80-15469*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

### THE CROP ASSESSMENT SUBSYSTEM: SYSTEM IMPLEMENTATION AND APPROACHES USED FOR THE GENERATION OF CROP PRODUCTION REPORTS

W. E. McAllum, R. E. Hatch (Department of Agriculture, Houston, Tex.), S. M. Boatwright (Ford Aerospace and Communications Corp., Houston, Tex.), C. J. Liszcz (Lockheed Electronics Co., Houston, Tex.), and S. M. Evans, Principal Investigators (Department of Agriculture, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 227-241 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The primary responsibility of the crop assessment subsystem (CAS) during the three phases of LACIE was to produce crop reports that included estimates of wheat area, yield, and production, as well as a specified set of associated statistical descriptors. The operations of CAS are described with emphasis on sampling strategy, input/output data, evolution of aggregation/reporting system capabilities, and CAS aggregation procedures. A.R.H.

**N80-15470*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

### LACIE STATUS AND TRACKING

V. M. Dauphin, C. H. Jeffress (Lockheed Electronics Co., Houston, Tex.), and J. M. Everette, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 243-248 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The operational requirements and development of a system designed to meet LACIE needs for data to be available at given stations simultaneously, to measure throughput rates, and perform efficiency analyses are described. The final automated status and tracking system (ASATS) is defined and problems encountered during its evolutionary process are discussed. A.R.H.

**N80-15471*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

### LACIE QUALITY ASSURANCE

G. L. Gutschewski, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 249-255 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Topics covered include (1) development of the LACIE quality assurance program; (2) LACIE quality assurance responsibilities of all organizational elements; (3) internal quality assurance support; and (4) accomplishments. A.R.H.

**N80-15472*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

### ACCURACY ASSESSMENT SYSTEM AND OPERATION

D. E. Pitts, A. G. Houston, G. Badhwar, M. J. Bender, M. L. Rader (Lockheed Electronics Co., Houston, Tex.), W. G. Eppler (Lockheed Missiles and Space Co., Palo Alto, Calif.), C. W. Ahlers (Lockheed Electronics Co., Houston, Tex.), W. P. White (Lockheed Electronics Co., Houston, Tex.), R. R. Vela, and E. M. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 265-288 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198
ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of LACIE estimates of wheat production, area, and yield is determined at regular intervals throughout the year by the accuracy assessment subsystem which also investigates the various LACIE error sources, quantifies the errors, and relates then to their causes. Timely feedback of these error evaluations to the LACIE project was the only mechanism by which improvements in the crop estimation system could be made during the short 3 year experiment. A.R.H.

**N80-15473*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LACIE APPLICATIONS EVALUATION SYSTEM EFFICIENCY REPORT**
Timothy T. White, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 281-288 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The scope of the three LACIE phases is discussed as well as the system efficiencies which had to be implemented to cope with the resulting LANDSAT data load. The methodologies used in system analysis, some of the specific data collected, and the inferences of these data and their implication on future systems are also discussed. A.R.H.

**N80-15474*#** Lockheed Electronics Co., Houston, Tex.
**CARTOGRAPHY: LACIE'S SPATIAL PROCESSOR**
M. L. Rader and R. R. Vela, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 291-296 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The spatial processing needs of LACIE include the location of agricultural test sites, and the registration of ground truth to LANDSAT imagery. The technological aspects of LACIE cartographic support, the need for cartography in satellite crop surveys, and proposed improvements which would enhance support of future programs are discussed. A.R.H.

**N80-15475*#** IBM Federal Systems Div., Houston, Texas.
**THE LACIE DATA BASES: DESIGN CONSIDERATIONS**
L. E. Westberry, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 297-306 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The implementation of direct access storage devices for LACIE is discussed with emphasis on the storage and retrieval of image data. Topics covered include the definition of the problem, the solution methodology (design decisions), the initial operational structure, and the modifications which were incorporated. Some conclusions and projections of future problems to be solved are also presented. A.R.H.

**N80-15476*#** IBM Federal Systems Div., Houston, Texas.
**MAN-MACHINE INTERFACES IN LACIE/ERIPS**
Barbara B. Duprey, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 307-315 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
One of the most important aspects of the interactive portion of the LACIE/ERIPS software system is the way in which the analysis and decision-making capabilities of a human being are integrated with the speed and accuracy of a computer to produce a powerful analysis system. The three major man-machine interfaces in the system are (1) the use of menus for communications between the software and the interactive user; (2) the checkpoint/restart facility to recreate in one job the internal environment achieved in an earlier one; and (3) the error recovery capability which would normally cause job termination. This interactive system, which executes on an IBM 360/75 mainframe, was adapted for use in noninteractive (batch) mode. A case study is presented to show how the interfaces work in practice by defining some fields based on an image screen display, noting the field definitions, and obtaining a film product of the classification map. A.R.H.

**N80-15477*#** IBM Federal Systems Div., Houston, Texas.
**LACIE/ERIPS SOFTWARE SYSTEM SUMMARY**
C. L. Johnson, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 317-332 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The Earth resources interactive processing system (ERIPS) supports LACIE by classifying LANDSAT sensed data on the basis of the statistical similarity to those portions which were identified by analysts. The development and capabilities of the ERIPS software system are described with emphasis on (1) system requirements; (2) LACIE/ERIPS hardware; (3) system functions; (4) pattern recognition concept; and (5) LACIE/ERIPS data bases. Algorithms used in LACIE/ERIPS for statistics, divergence, feature selection, classification, registration, adaptive clustering, iterative clustering, clustering report functions, Sun angle correction, mean level adjustment, and bias correction are appended. A.R.H.

**N80-15479*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**VERY HIGH SPEED PROCESSING: APPLICABILITY OF PERIPHERAL DEVICES TO PIXEL-DEPENDENT TASKS**
J. C. Lyon, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 345-354 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
Early options studied in the satisfaction of LACIE implementation computational demands are described as well as the ultimate selection and development of an array processing solution to the problem. The economic justification, as a function of required LANDSAT analysis, is provided. The suitability of such processors for LACIE and other applications is discussed. A.R.H.

**N80-15480*#** IBM Federal Systems Div., Houston, Texas.
**A LOOK AT COMPUTER SYSTEM SELECTION CRITERIA**
E. W. Poole, F. L. Flowers, and W. I. Stanley, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 355-396 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
There is no difficulty in identifying the criteria involved in the computer selection process, complexity arises in objectively evaluating various candidate configurations against the criteria, based on the user's specific needs. A model for formalizing the selection process consists of two major steps: verifying that the candidate configuration is adequate to the user's programming requirements, and determining an overall system evaluation rating based on cost, usability, adaptability, and availability. A 36 step instruction for computer sizing evaluation is included in the appendix along with a sample application of the configuration adequacy model. Selection criteria and the weighting process are also discussed. A.R.H.

**N80-15481*#** Mitre Corp., Houston, Tex.
**COST AND PERFORMANCE CHARACTERISTICS OF DATA SYSTEM CONFIGURATIONS FOR PROCESSING REMOTELY SENSED DATA**
P. J. Gregor and J. F. Spitzer, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 397-408 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
Some alternative approaches to constructing a large remote-sensing data system are explored. The cost and performance implications of using a collection of 'small' computers versus using one large computer are examined. Several architectures and associated costs for the large data system supporting a single data center are presented. Recurring cost factors (maintenance and operations) currently slightly favor the single large-machine architecture, but other factors may dictate the choice of one of the two multimachine architectures discussed. A.R.H.

**N80-15482*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**THE LACIE CROP YEARS: AN ASSESSMENT OF THE CROP CONDITIONS EXPERIENCED IN THE THREE YEARS OF LACIE**
J. D. Hill (NOAA Environmental Data and Information Service, Houston, Tex.) and D. R. Thompson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 411-429 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Meteorological data and LANDSAT spectral data from growing regions in the U.S. Great Plains, the U.S.S.R., and Canada were used to assess growing conditions and to document where anomalies such as drought, floods, and freezes were impacting the crop yield and appearance of spring and winter wheat. In the United States, the weekly rainfall and temperature data were used to estimate soil moisture, which was then related to crop needs by a crop moisture index. The transformation of LANDSAT digital data into a green index number provided a procedure whereby data from a LACIE segment could be classified as drought affected or not. The growing seasons encountered in each LACIE country during the three phases are described. A.R.H.

**N80-15483*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**APPLICATION OF LANDSAT DIGITAL DATA FOR MONITORING DROUGHT**
D. R. Thompson and O. A. Wehmanen, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 431-438 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A technique utilizing transformed LANDSAT digital data for detection of agricultural vegetative water stress was developed during the 1976 South Dakota drought, and expanded to the U.S. Great Plains the following year to evaluate its effectiveness in detecting and monitoring vegetative stress water stress over large areas. This technique, the green index number (GIN), indicated when the vegetation within a segment was undergoing stress. Segments were classified as either moisture-stressed or normal using remote sensing techniques combined with a knowledge of crop condition. The remote sensing-based information was compared to a weekly ground-based index (the crop moisture index) provided by the U.S. Dept. of Commerce. The approaches used and the results from the GIN monitoring program are presented. A.R.H.

**N80-15484*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S. GREAT PLAINS**
Duane L. Marquis, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 439-479 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of the LACIE design was tested using the nine states of the U.S. Great Plains where comparison data was available. The three phases of LACIE are discussed with respect to the scope; sampling; LANDSAT data; estimates of area, yield, and production; accuracy of the estimates; and technical issues related to each phase. A.R.H.

**N80-15485*#** Department of Agriculture, Houston, Tex.
**LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S.S.R.**
J. R. Hickman, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 481-512 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

No estimates were generated for the U.S.S.R. during LACIE phase 1. Phase 2 effort was limited to two indicator regions: winter wheat areas where 385 segments were allocated, and spring wheat areas with 362 allocated segments. The level of activity for phase 3 was extended to the entire country which automatically increased the segment workload from 747 to 1947 segments. Production, area, and yield estimates, and their accuracy are discussed for phases 2 and 3 with emphasis on scope, sampling strategy, data base, LANDSAT data, yield analysis for winter and spring wheat, area and production analysis for winter and spring wheat, and technical issues and problems. A.R.H.

**N80-15486*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: CANADA**
Delanne Conte (USDA Foreign Agricultural Service, Houston, Tex.), A. G. Houston, and L. O. Lovfald, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 513-526 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling segment allocation for Canada placed 283 segments within three provinces: Saskatchewan (170), Alberta (75), and Manitoba (38). The data base was comprised of five data sets: allocation, historical, ratio, LANDSAT, and yield. In-season area, yield, and production estimates were generated only during phase 2. These data are presented and analyzed. A.R.H.

**N80-15487*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ACCURACY AND PERFORMANCE OF LACIE AREA ESTIMATES**
J. F. Potter (Lockheed Electronics Co., Houston, Tex.), E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), A. G. Houston, and D. E. Pitts, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 527-573 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Results for the three crop years between 1974 and 1977 are presented in 25 tables for four regions of the U.S. Great Plains. Topics covered include error source analyses and special studies during each phase. Abnormal signature and boundary problems still under investigation are examined. A.R.H.

**N80-15488*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ACCURACY AND PERFORMANCE OF LACIE YIELD ESTIMATES IN MAJOR WHEAT PRODUCING REGIONS OF THE WORLD**
D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), R. G. Stuff, A. G. Houston, E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), and M. H. Trenchard, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 575-587 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The LACIE yield models developed, implemented, and tested during the three phases of the experiment represent the first generation of models designed for the large-scale prediction of wheat production. The models are capable of supporting the stated project goal of being within 10 percent of the actual wheat production 90 percent of the time. The limitations of the models are inherent in their nature. The temporal resolution limits their ability to handle the erratic weather occurring in critical situations. The relatively large spatial resolution of the individual models limits the capture of localized but important episodic events. A.R.H.

**N80-15489*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ACCURACY AND PERFORMANCE OF LACIE CROP DEVELOPMENT MODELS**
S. K. Woolley (Lockheed Electronics Co., Houston, Tex.), V. S. Whitehead, R. G. Stuff, and W. E. Crea, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 589-604

refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three principal phenological crop calendar models evaluated for LACIE, Robertson's triquadratic model which predicts the rate of progression of wheat through its biological development, was selected. Daily maximum and minimum temperatures and day length are the input variables, and the principal output is a daily increment of development through six physiological growth stages. Because wheat corresponds differently to the environment during each growth stage, five different equations are required. The estimated and observed crop development data were compared in order to establish a measure of confidence in the model and to identify consistent discrepancies that would adversely affect LACIE operation. Although the model provided reliable estimates for various wheat growing regions of the world, it was found that there are still areas in need of further model improvement or development. A.R.H.

**N80-15490*#** Department of Agriculture, Washington, D.C.
**ECONOMIC EVALUATION: CONCEPTS, SELECTED STUDIES, SYSTEM COSTS, AND A PROPOSED PROGRAM**
Frank H. Osterhoudt, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 605-616 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The more usual approaches to valuing crop information are reviewed and an integrated approach is recommended. Problems associated with implementation are examined. What has already been accomplished in the economic evaluation of LACIE-type information is reported including various studies of benefits. The costs of the existing and proposed systems are considered. A method and approach is proposed for further studies. A.R.H.

**N80-15491*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**METHODS FOR SEGMENT WHEAT AREA ESTIMATION**
R. P. Heydorn, M. C. Trichel, and J. D. Erickson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 621-632 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The major research conducted during the three years of LACIE to solve problems associated with segment wheat area estimation is reviewed. Topics covered include proportion estimation, clustering, feature extraction, and signature extension. It would appear that LANDSAT-1 and LANDSAT-2 data do not contain enough information to discriminate between crop types perfectly all the time and, therefore, a basic problem arises when no ground truth data on crop types in the area are available. New approaches are needed to reduce labeling error. Perhaps better use of multiyear LANDSAT data, a more detailed understanding of the cropping practices in the area, better crop calendar prediction, and a better understanding of the limiting sources of error in LANDSAT data related to crop discrimination may provide the insight required to develop improved designs. A.R.H.

**N80-15492*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ESTIMATING CROP PROPORTIONS FROM REMOTELY SENSED DATA**
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 633-646 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The classification/pixel-count method for estimating the proportion of wheat in each segment is theoretically biased even if all distributional assumptions are met. Alternative ways to estimate crop proportions are examined and their performance testing is considered. Topics covered include general linear functional estimates, the method of moments, and maximum likelihood estimators. A.R.H.

**N80-15494*#** Lockheed Electronics Co., Houston, Tex.
**ON EVALUATING CLUSTERING PROCEDURES FOR USE IN CLASSIFICATION**
M. D. Pore, T. E. Moritz, D. T. Register, S. S. Yao, and W. G. Eppler, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 661-669 refs ERTS
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of evaluating clustering algorithms and their respective computer programs for use in a preprocessing step for classification is addressed. In clustering for classification the probability of correct classification is suggested as the ultimate measure of accuracy on training data. A means of implementing this criterion and a measure of cluster purity are discussed. Examples are given. A procedure for cluster labeling that is based on cluster purity and sample size is presented. A.R.H.

**N80-15497*#** Environmental Research Inst. of Michigan, Ann Arbor.
**FEATURE EXTRACTION APPLIED TO AGRICULTURAL CROPS AS SEEN BY LANDSAT**
R. J. Kauth, P. F. Lambeck, W. Richardson, G. S. Thomas, and A. P. Pentland, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 705-721 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The physical interpretation of the spectral-temporal structure of LANDSAT data can be conveniently described in terms of a graphic descriptive model called the Tassled Cap. This model has been a source of development not only in crop-related feature extraction, but also for data screening and for haze effects correction. Following its qualitative description and an indication of its applications, the model is used to analyze several feature extraction algorithms. A.R.H.

**N80-15499*#** California Univ. at Berkeley.
**DEVELOPMENT OF PARTITIONING AS AN AID TO SPECTRAL SIGNATURE EXTENSION**
R. W. Thomas, C. M. Hay, and J. C. Claydon, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 739-755 refs ERTS

(Contract NAS9-14565)
Avail: NTIS HC A99/MF A01 CSCL 02C

Lists of spectrally similar LACIE sample segments may be constructed with the use of three basic information types: static, seasonal, and pass-specific variables. All are related directly or indirectly to spectral signature behavior and can be used to define spatial domains over which crop-specific signatures should be extendable. Topics covered include: (1) static spectral stratification; (2) evaluation of static partitions relative to variance control objectives; (3) evaluation of the relative importance of static versus seasonal and pass-specific partitioning variables in spectral variability; and (4) a current perspective on partitioning. A.R.H.

**N80-15500*#** Lockheed Electronics Co., Houston, Tex.
**METHODS OF EXTENDING CROP SIGNATURES FROM ONE AREA TO ANOTHER**
T. C. Minter, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 757-800 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Efforts to develop a technology for signature extension during LACIE phases 1 and 2 are described. A number of haze and Sun angle correction procedures were developed and tested. These included the ROOSTER and OSCAR cluster-matching algorithms and their modifications, the MLEST and UHMLE maximum likelihood estimation procedures, and the ATCOR procedure. All these algorithms were tested on simulated data and consecutive-day LANDSAT imagery. The ATCOR, OSCAR,

and MLEST algorithms were also tested for their capability to geographically extend signatures using LANDSAT imagery.
Author

**N80-15501*#** Environmental Research Inst. of Michigan, Ann Arbor.
**SIGNATURE EXTENSION METHODS IN CROP AREA ESTIMATION**
R. J. Kauth and W. Richardson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 801-823 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The Procedure B multispectral processing system is both multisegment and multistratum. It uses data from several LACIE-sized segments together and makes a proportion estimate for the entire group of segments as well as for the individual segments. In the clustering of data features, Procedure B produces multiple classes or strata rather than just two strata (as in Procedure 1), and performs stratified sampling on each of these mutliple strata in order to make a proportion estimate. Tests results for the components and for the overall performance of Procedure B are presented, and conclusions that can be drawn from these tests are discussed. The rationale for signature extension for crop area estimation is summarized. A.R.H.

**N80-15502*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**AN EVALUATION OF PROCEDURE 1**
S. G. Wheeler (IBM, Houston, Tex.), R. P. Heydorn, P. N. Misra (IBM, Houston, Tex.), W. Lee, Jr. (IBM, Houston, Tex.), and R. T. Smart, Principal Investigators (IBM, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul 1979 p 825-842 ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C
LACIE Procedure 1 has undergone continuous testing and evaluation, starting with analytical and experimental studies even before it was implemented in ERIPS software and continuing to the present with performance evaluations using blind-site data. The strengths and weaknesses of the procedure are indicated and some areas for possible improvement are identified. Results from three of the experiments performed and an evaluation of LACIE Procedure 1 proportion estimates for some blind-site segments are discussed. A.R.H.

**N80-15503*#** Department of Agriculture, Houston, Tex. Foreign Agricultural Service.
**THE VEGETATIVE INDEX NUMBER AND CROP IDENTIFICATION**
P. Ashburn, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 843-855 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
A vegetative index number of numerical value was calculated from the digital values of the LANDSAT system to provide some measure of green growing vegetation. The usefulness of the green numbers for schemes in crop identification and acreage estimation is investigated and the Ashburn vegetation index (AVI) is compared with the Kauth-Thomas vegetation index (KVI) for crop identification schemes. Results of wheat acreage estimation using LACIE Procedure 1 and the AVI for eight sample segments are given. Tables show comparisons between the AVI and the KVI as well as visual results of the AVI. A.R.H.

**N80-15504*#** California Univ. at Berkeley.
**MANUAL LANDSAT DATA ANALYSIS FOR CROP TYPE IDENTIFICATION**
C. M. Hay, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 857-866 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The process of manual identification of crop type by human analysts and problems associated in LACIE that were associated with manual crop identification measurement procedures are described. Research undertaken in cooperation with LACIE operations by the supporting research community to effect solutions to, or obtain greater understanding of the problems is discussed. A.R.H.

**N80-15505*#** Lockheed Electronics Co., Houston, Tex.
**LACIE ANALYST INTERPRETATION KEYS**
J. G. Baron, R. W. Payne, and W. F. Palmer, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 867-886 ref Original contains imagery. Original photography may be purchased from the EROS data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
Two interpretation aids, 'The Image Analysis Guide for Wheat/Small Grains Inventories' and 'The United States and Canadian Great Plains Regional Keys', were developed during LACIE phase 2 and implemented during phase 3 in order to provide analysts with a better understanding of the expected ranges in color variarion of signatures for individual biostages and of the temporal sequences of LANDSAT signatures. The keys were tested using operational LACIE data, and the results demonstrate that their use provides improved labeling accuracy in all analyst experience groupings, in all geographic areas within the U.S. Great Plains, and during all periods of crop development. A.R.H.

**N80-15506*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**COLORIMETRIC CONSIDERATION OF TRANSPARENCIES FOR A TYPICAL LACIE SCENE**
R. D. Juday, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 887-897 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
The production film converter used to produce LACIE imagery is described as well as schemes designed to provide the analyst with operational film products. Two of these products are discussed from the standpoint of color theory. Colorimetric terminology is defined and the mathematical calculations are given. Topics covered include (1) history of product 1 and 3 algorithm development; (2) colorimetric assumptions for product 1 and 3 algorithms; (3) qualitative results from a colorimetric analysis of a typical LACIE scene; and (4) image-to-image color stability. A.R.H.

**N80-15507*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**GENERATION OF UNIFORM CHROMATICITY SCALE IMAGERY FROM LANDSAT DATA**
R. D. Juday, F. Johnson, R. A. Abotteen (Lockheed Electronics Co., Houston, Tex.), and M. D. Pore, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 899-910 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C
An algorithm is presented for generating uniform chromaticity scale (UCS) imagery from multispectral data. A computer program was written to implement the algorithm, and UCS film products were generated. The colors in the film and their temporal change are consistent with those expected for the particular scaling of Krauth components into the (lab) color space. The film product was not subjected to the practical test of competing with previous transformations. Preliminary examination indicates that the product offers the following possibilities: (1) a single film product that will supplant two film products in current use; (2) improved visibility of data differences in regions in data space that are critical to crop identification; and (3) an analytic route to the determination of data-space transformations that will be optimal for particular discrimination problems. A.R.H.

**N80-15509*#** Lockheed Electronics Co., Houston, Tex.
**A PROGRAMMED LABELING APPROACH TO IMAGE INTERPRETATION**
M. D. Pore and R. A. Abotteen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 923-935 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Manual labeling techniques require the analyst-interpreter to use not only production film converter products but also agricultural and meteorological data and spectral aids in an integrated, judgmental fashion. To control an anticipated high variance in these techniques, a semiautomatic labeling technology was developed. The product of this technology is label identification from statistical tabulation (LIST) which operates from a discriminant basis and has the ability to measure the reliability of the label and to introduce an arbitrary bias. The development of LIST and its properties are described. Numerical results of an application are included and the evaluation of LIST is discussed. A.R.H.

**N80-15510*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**STATUS OF YIELD ESTIMATION TECHNOLOGY: A REVIEW OF SECOND-GENERATION MODEL DEVELOPMENT AND EVALUATION**
R. G. Stuff, T. L. Barnett, G. O. Boatwright, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and V. S. Whitehead, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 937-950 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Multiple regression models were studied in order to determine their yield estimation capability for any arbitrary unit area and to obtain greater responsiveness and accuracy through the use of additional data sources applied at smaller spatial and temporal scales. It was concluded that data base inadequacy was the factor limiting performance in the models studied and that each of the models has more yield predicting capability than was reached during LACIE. K.L.

**N80-15511*#** Kansas State Univ., Manhattan.
**A UNIVERSAL MODEL FOR ESTIMATING WHEAT YIELDS**
A. M. Feyerherm and G. M. Paulsen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 951-959 refs ERTS

(Contracts NAS9-14282; NAS9-14533)
(CONTRIB-78-268-A) Avail: NTIS HC A99/MF A01 CSCL 02C

A universal wheat yield model applicable to both fall- and spring-planted wheat was developed to show separate and joint effects of weather and culture on yields. Data from state experiment stations in a wide range of climates in the U.S. Great Plains were used to build basic relationships among yields, weather, and culture. The application of the model on a macroclimatic scale in the U.S., the U.S.S.R., and India is discussed along with potential improvements. K.L.

**N80-15512*#** Lockheed Electronics Co., Houston, Tex.
**THE LAW OF THE MINIMUM AND AN APPLICATION TO WHEAT YIELD ESTIMATION**
R. B. Cate, D. E. Phinney, and M. H. Trenchard, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 961-969 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The adaptation of the law of the minimum (LOM) to wheat yield estimation is discussed. It is demonstrated through a trial application that the LOM concept is a valuable tool for model building when regression tools are inadequate. K.L.

**N80-15513*#** National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment.
**CCEA SECOND-GENERATION WHEAT YIELD MODEL FOR HARD RED WHEAT IN NORTH DAKOTA**
S. K. LeDuc, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 971-979 refs Presented at the Crop Modeling Workshop, Columbia, Mo., 3-5 Oct. 1977 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of estimating wheat yields for years with unusual planting dates and/or unusual phenological development is investigated. A yield model developed for hard red spring wheat in North Dakota using historical yields for crop reporting districts in conjunction with meteorological predictor variables based on weekly data is assessed. K.L.

**N80-15514*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**PREDICTION OF WHEAT PHENOLOGICAL DEVELOPMENT: A STATE-OF-THE-ART REVIEW**
M. W. Seeley (Lockheed Electronics Co., Houston, Tex.), M. H. Trenchard (Lockheed Electronics Co., Houston, Tex.), D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), J. R. Baker, and R. G. Stuff, Principal Investigators (Fort Lewis Coll., Durango, Colo.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 981-989 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The merits and shortcomings of LACIE wheat development models are described. The effects of planting dates, spatial errors in the variables, and model forms on accuracy are discussed. K.L.

**N80-15515*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**NEW DEVELOPMENTS IN SAMPLING AND AGGREGATION FOR REMOTELY SENSED SURVEYS**
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 991-993 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling techniques used to construct large area crop estimates are briefly reviewed. Problem areas in sampling and aggregation are covered. The natural sampling strategy, two phase sampling, weighted aggregation, and multiyear estimation are among the topics discussed. J.M.S.

**N80-15516*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**NATURAL SAMPLING STRATEGY**
C. R. Hallum and J. P. Basu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 995-1013 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A natural stratum-based sampling scheme and the aggregation procedures for estimating wheat area, yield, and production and their associated prediction error estimates are described. The methodology utilizes LANDSAT imagery and agrophysical data to permit an improved stratification in foreign areas by ignoring political boundaries and restratifying along boundaries that are more homogeneous with respect to the distribution of agricultural density, soil characteristics, and average climatic conditions. A summary of test results is given including a discussion of the various problems encountered. J.M.S.

**N80-15517*#** Texas A&M Univ., College Station.
**MULTIYEAR ESTIMATES FOR THE LACIE SAMPLING PLANS**
H. O. Hartley, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1015-1028 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

An approach that may be useful in improving the estimates of the wheat acreages for the LACIE countries for each year by using the short-time series of estimates made in the sequence of consecutive years is presented. A simple 'synthesis' based method of variance component estimation is described. A general theorem concerning weighted least squares, referred to as the Aiken method, is proved. J.M.S.

**N80-15518*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**WEIGHTED AGGREGATION**
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1029-1036 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The use of a weighted aggregation technique to improve the precision of the overall LACIE estimate is considered. The manner in which a weighted aggregation technique is implemented given a set of weights is described. The problem of variance estimation is discussed and the question of how to obtain the weights in an operational environment is addressed. J.M.S.

**N80-15519*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**DESIGN, IMPLEMENTATION, AND RESULTS OF LACIE FIELD RESEARCH**
M. E. Bauer (Purdue Univ., Lafayette, Ind.), M. C. McEwen, W. A. Malila (ERIM, Ann Arbor, Mich.), and J. C. Harlan, Principal Investigators (Texas A and M Univ., College Station) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1037-1066 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The capability to acquire, process, and interpret remotely sensed multispectral measurements of the energy reflected and emitted from crops, soils, and other Earth surface features is considered. The LACIE Field Measurements Project is described including project objectives, the experimental approach, the data acquisition program, and selected results based on field data. The key accomplishments and results of the experiment and recommendations for future field research are summarized. J.M.S.

**N80-15520*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**THE APPLICATION TEST SYSTEM: AN APPROACH TO TECHNOLOGY TRANSFER**
A. C. Aaronson (Dept. of Agriculture, Houston, Tex.), K. Buelow (Dept. of Agriculture, Houston, Tex.), F. C. David (Dept. of Agriculture, Houston, Tex.), R. L. Packard (Dept. of Agriculture, Houston, Tex.), and F. W. Ravet, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1069-1074 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

The latest satellite and computer processing and analysis technologies were tested and evaluated in terms of their application feasibility. Technologies evaluated include those developed, tested, and evaluated by the LACIE, as well as candidate technologies developed by the research community and private industry. The implementation of the applications test systdm and the technology transfer experience between the LACIE and the applications test system is discussed highlighting the approach, the achievements, and the shortcomings. J.M.S.

**N80-15521*#** Department of Agriculture, Houston, Tex.
**FUNCTIONAL DEFINITION AND DESIGN OF A USDA SYSTEM**
S. M. Evans, E. R. Dario, and G. L. Dickinson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1075-1084 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The fundamental definition and design of a U.S.D.A. system utilizing the LACIE technology available as of June 1976, is discussed. The organization and methods described are focused on LACIE technology in terms of its transfer for use applications. The simulation of a feasible system design provided timely answers to system design questions, such as the ability of a minicomputer to handle the proposed geometrical correction of MSS data. M.M.M.

**N80-15522*#** Department of Agriculture, Houston, Tex.
**DATA BASE DESIGN FOR A WORLDWIDE MULTICROP INFORMATION SYSTEM**
W. G. Driggers, J. M. Downs, J. R. Hickman, and R. L. Packard, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 ( Jul. 1979 p 1085-1096 refs ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C

A description of the USDA Application Test System data base design approach and resources is presented. The data is described in detail by category, with emphasis on those characteristics which influenced the design most. It was concluded that the use of a generalized data base in support of crop assessment is a sound concept. The IDMS11 minicomputer base system is recommended for this purpose. M.M.M.

**N80-15523*#** Ford Aerospace and Communications Corp., Houston, Tex.
**THE APPLICATION TEST SYSTEM: TECHNICAL APPROACH AND SYSTEM DESIGN**
J. L. Benson, D. R. McClelland, J. D. Tarbet, and R. F. Purnell, Principal Investigators (Dept. of Agriculture, Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1097-1101 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

An insight is provided of the technical approach which was applied to the system design of the USDA Applications Test Program. Included are: identification of requirements, assessment of remote sensing contributions, evaluations of existing techniques, and cost effective development of a system design which utilizes techniques and procedures consistent with requirements. M.M.M.

**N80-15524*#** Department of Agriculture, Houston, Tex.
**RESOURCE MODELING: A REALITY FOR PROGRAM COST ANALYSIS**
L. D. Fouts and R. L. Hurst, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jun. 1979 p 1103-1120 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The approach, implementation, operation, and utilization of a model to establish capital investment and operational costs for the Program is presented. These are based on their interrelationships, dependencies, and alternative actions. M.M.M.

**N80-15525*#** Department of Agriculture, Houston, Tex.
**THE APPLICATION TEST SYSTEM: EXPERIENCES TO DATE AND FUTURE PLANS**
G. A. May, P. Ashburn, and H. L. Hansen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Session, Vol. 1 and 2 Jul. 1979 p 1121-1125 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The ATS analysis component is presented focusing on methods by which the varied data sources are used by the ATS analyst. Analyst training and initial processing of data is discussed along with short and long plans for the ATS. M.M.M.

**N80-15527*#** Instituto Geografico Nacional, Madrid (Spain).
**THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report**
Rudolfo NunezdelasCuevas, Fernando LopezdeSagredo, D. Joaquin Melia Miralles, D. Pedro Herranz Araujo, D. Jesus Paredes Perlado, D. Antonio Parrilla, D. J. Luis Picon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez, Principal Investigators 30 Sep. 1979 47 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10032; NASA-CR-162443; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08F

**N80-15530*#** Canada Centre for Remote Sensing, Ottawa (Ontario).

**USE OF THERMAL INFRARED AND COLOUR INFRARED IMAGERY TO DETECT CROP MOISTURE STRESS Interim Report**

R. C. McKenzie, N. F. Clark, and J. Cihlar, Principal Investigators Mar. 1979 36 p refs Sponsored by NASA ERTS
(E80-10036; NASA-CR-162447) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. In the presence of variable plant cover (primarily percent cover) and variable available water content, the remotely sensed apparent temperatures correlate closely with plant cover and poorly with soil water. To the extent that plant cover is not systematically related to available soil water, available water in the root zone values may not be reliably predicted from the thermal infrared data. On the other hand, if plant cover is uniform and the soil surface is shown in a minor way, the thermal data indicate plant stress and consequently available water in the soil profile.

**N80-15531*#** Canada Centre for Remote Sensing, Ottawa (Ontario). Applications Div.

**HCMM/SOIL MOISTURE EXPERIMENT Progress Report**

Josef Cihlar, Principal Investigator 31 Aug. 1979 12 p refs Sponsored by NASA ERTS
(E80-10037; NASA-CR-162448) Avail: NTIS HC A02/MF A01 CSCL 08M

**N80-15534*#** Environmental Research Inst. of Michigan, Ann Arbor.

**ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Jun. - 14 Sep. 1979**

R. Cicone, E. Crist, Q. Holmes, R. J. Kauth, W. A. Malila, and W. Pont, Principal Investigators Oct. 1979 151 p EREP
(Contract NAS9-15476)
(E80-10040; NASA-CR-160362; ERIM-132400-28-P) Avail: NTIS HC A08/MF A01 CSCL 02C

**N80-15535*#** National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

**DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA**

M. Kristine Butera Oct. 1979 27 p refs
(NASA-TP-1553; S-492) Avail: NTIS HC A03/MF A01 CSCL 08B

The success of remotely mapping wetland vegetation of the southwestern coast of Florida is examined. A computerized technique to process aircraft and LANDSAT multispectral scanner data into vegetation classification maps was used. The cost effectiveness of this mapping technique was evaluated in terms of user requirements, accuracy, and cost. Results indicate that mangrove communities are classified most cost effectively by the LANDSAT technique, with an accuracy of approximately 87 percent and with a cost of approximately 3 cent per hectare compared to $46.50 per hectare for conventional ground survey methods. R.C.T.

**N80-15542#** National Technical Information Service, Springfield, Va.

**REMOTE SENSING OF AGRICULTURAL RESOURCES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1973 - Sep. 1979**

Audrey S. Hundemann Oct. 1979 245 p Supersedes NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068
(NTIS/PS-79/0993/0; NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068) Avail: NTIS HC $28.00/MF $28.00 CSCL 03D

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resource assessment. This updated bibliography contains 239 abstracts, 28 of which are new entries to the previous edition. GRA

**N80-15549#** Economics, Statistics and Cooperatives Service, Washington, D. C. Statistical Research Div.

**OBTAINING TIMELY CROP AREA ESTIMATES USING GROUND-GATHERED AND LANDSAT DATA**

George Hanuschak, Richard Sigman, Michael Craig, Martin Ozga, and Raymond Luebbe Aug. 1979 35 p refs
(PB-300825/7; TB-1609) Avail: NTIS HC A03/MF A01 CSCL 02C

The NASA Earth resources monitoring satellites, LANDSAT 2 and 3, were used with conventional ground-gathered data to estimate planted crop areas for the 1978 Iowa corn and soybean crops. Estimates that used LANDSAT data and ground data jointly were substantially more precise than those made from ground data alone. These estimates were one of several data sources used in determining the official year-end Annual Crop Summary for Iowa. Problems associated with total project cost, timely delivery of LANDSAT data to the USDA, and cloud cover must be solved prior to any planning for an operational program. GRA

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# 02

# ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

**Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.**

**A80-14705** # **Environmental monitoring systems.** E. P. Parry (Rockwell International Environmental Monitoring and Services Center, Newbury Park, Calif.). In: Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings. Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 85-92.

The measurement of environmental pollutants involves the use of both continuous and integrated analyzers. A combination of sensor instrumentation, sampling system, and data acquisition system comprises an environmental monitoring system for sampling either air or water. The nature of ambient air monitoring systems will be discussed. Techniques used to measure various pollutants and principles of continuous sensor instrumentation will be discussed. Both sophisticated and simple environmental monitoring systems will be shown. Environmental monitoring systems for water will also be described giving the nature of and reason for integrated samplers. Recent advances in electronics and computer technology on environmental systems continue to have an impact. Finally, the application of various systems to monitoring programs and widely varying objectives, the basis for selection of systems, and the trade-offs which can be used will be given with some illustrative examples. (Author)

**A80-15556** * **Assessment of the urban heat island effect through the use of satellite data.** J. C. Price (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, Md.). *Monthly Weather Review*, vol. 107, Nov. 1979, p. 1554-1557. 12 refs.

A recent NASA satellite is obtaining high spatial resolution thermal infrared data at times of day appropriate for the study of the urban heat island effect. Quantitative estimates of the extent and intensity of urban surface heating are obtained by analysis of digital data acquired over the New York City-New England area. In many large cities satellite sensed temperatures are 10-15 C warmer than in surrounding rural areas. A thorough interpretation of the elevated urban surface temperature will require studies of (1) the relationship between remotely sensed surface temperatures and air temperatures, and (2) compensation for observed very localized heating due to industry and/or power plants. (Author)

**A80-15774** # **The use of remote sensing for transport planning and highway engineering in developing countries.** T. E. Beaumont (Fairey Surveys, Ltd., Maidenhead, Berks., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 17, 19-26. 13 refs.

Rapid methods of terrain appraisal are becoming increasingly important in developing countries in helping transport planners and highway engineers to make early and effective decisions about the location and design of new roads. Recent developments in the collection and analysis of terrain data recorded by remote sensing systems have resulted in a new era in the application of surveillance techniques to the planning, design, construction and maintenance of highways in different overseas environments. This paper discusses the advantages of using these new remote sensing methods for highway engineering surveys and gives examples of recent applications of the techniques to projects in Botswana, Ethiopia and Nepal. (Author)

**A80-20259** **Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas.** V. I. Myers, D. G. Moore, M. DeVries, and B. Worcester. In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 396-422. 13 refs.

In productive areas where deteriorations of resources is already in an advanced stage, planning and rehabilitation requires an assessment of resources and the determination of their vulnerability to further damage, as well as their potential for rehabilitation and development. In the present paper, it is shown how remote sensing technology can be used to obtain many of the early diagnostic indicators of desertification, as well as an assessment of resources and their potential in cases where the processes are advanced. V.P.

**A80-20263** **The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act.** G. Schultink (Michigan State University, East Lansing, Mich.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 468-479. 21 refs.

**A80-15782** # **Land use mapping in the Sahel zone using Landsat.** C. Bardinet (Ecole Normale Supérieure, Montrouge, Hauts-de-Seine, France), J.-M. Monget, and M. Poisson (Paris, Ecole Nationale Supérieure des Mines, Paris, France). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 85, 87-90.

The LANCHAD mapping project was initiated under a joint research effort of both the Chad University and Paris 1 University. The aim of this project was to develop research and teaching in land use and cartography using remote sensing from satellites. The LANCHAD acronym (land use in Chad) clearly indicates that the subject of this study was to produce maps of use to local land managers. The kind of information obtained from Landsat is particularly useful in the planning of urban development, in this case in the Sahel type environment of Chad. The concentration of population with traditional ways of life is inducing rapid changes in the natural environment surrounding the large towns. Desertification and increased erosion in deforested areas, as well as the need for new agricultural areas, are typical problems which can be approached by multitemporal classification of satellite data. The first results have been obtained for the N'Djamena area which is the capital city of Chad, but the study will be extended to the entire country during a five year survey. (Author)

**A80-20025** **Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos.** H. Turner (Toronto, University, Mississauga, Ontario, Canada) and D. Steiner (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland). *Photogrammetria*, vol. 35, Nov. 1979, p. 141-160. 17 refs. National Research Council of Canada Grant No. A-7501.

This paper investigates the use of shadows on aerial photographs to obtain ground parameters (length, width, height, area and volume) of buildings by image processing technique. The assumptions of flat ground and true vertical photography are made in the study, and the investigation is performed on a scale model of an urban environment. Only the case of separate shadows is examined, and no attempt is made to deal with the cases of overlapping shadows and shadows falling on other buildings. The numerical values of the building parameters obtained by image processing are compared with the corresponding 'true' values measured directly on the scale model and a statistical error analysis is performed. The presence of a systematic error is detected in the height and volume residuals. A working model, based upon regression analysis, is suggested for use with actual aerial photographs. (Author)

## 02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

**A80-20241** **The use of Landsat imagery to monitor desert encroachment in arid areas.** A. M. Brera and F. Shahrokhi (Tennessee, University, Tullahoma, Tenn.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 58-68. 20 refs.

Major programs of sand fixation and afforestation have been undertaken by the Libyan Government. The purpose of these programs is to prevent sand dune encroachment over newly developed agricultural projects in the southern part of the country. Analysis of the imagery available from Landsat 1 and 2 for the period between 1972 to 1977 using digital and analogue techniques over selected test areas in the Libyan Desert has been undertaken. The results of this analysis has demonstrated that desert spreading can be estimated effectively and most economically through the use of Landsat imagery if proper image analysis techniques are used. (Author)

**A80-20246** **A suggested method for delimiting urbanized areas using digital Landsat data.** R. Ellefsen and D. Peruzzi (San Jose State University, San Jose, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 176-183. 6 refs.

Manipulation of a land-use map product generated by computer-aided analysis of Landsat digital data has been used, in a test case, to delimit the boundary of an urbanized area. Delimitation was determined by invoking rules adapted from the U.S. Census to encompass exclaves and to close embayments. The units of generalization were single urban pixels, groups of four, and groups of nine. The urbanized boundary was smoothed to varying degrees depending on whether the 'rule of one,' the 'rule of two' or the 'rule of three' was employed. This detailed set of systematic rules was developed with the hope of having universal applicability. (Author)

**A80-20251** **A light aircraft camera Pod - The Enviro-Pod.** G. E. Howard, Jr. (U.S. Environmental Protection Agency, Environmental Photographic Interpretation Center, Warrenton, Va.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 283-295.

The paper deals with an airborne self-contained low-cost remote sensing system, called the Enviro-Pod (Pod), developed for monitoring the environment of the United-States territory to ensure the validity of environmental standards and assure legal compliance. The results of feasibility tests and demonstrations indicate that the camera-configured Pod will acquire cost effectively high-quality high-resolution imagery in routine monitoring of point targets, stream segments, and small areas of generally less than 25 square miles. In its current configuration, the Pod provides high-resolution panoramic imagery in both the oblique and vertical camera positions. At a typical flight altitude of 3000 ft. the resolution of panchromatic film at nadir is 18 cm. V.P.

**A80-20255** **Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study.** T. Loveland, J. Schlesinger, and B. Ripple (South Dakota State Planning Bureau, Pierre, S. Dak.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 343-359.

The South Dakota State Planning Bureau recently completed a land capability study for Spearfish, South Dakota. This effort concentrated on the utilization of remote sensing data and computer composite mapping techniques. NASA high altitude aerial photography was interpreted to obtain land use information within the Spearfish area for 1969 and 1976. Detailed soils and surficial geology data were digitized, interpreted, and composited to determine the physical limitations in the area. The land capability data and the land use data were then composited to produce maps and statistics that related the area's physical limitations to actual, historical, and changing land use patterns. (Author)

**N80-10553*#** Smithsonian Institution, Washington, D. C.
**COLOR ZONING IN THE WESTERN DESERT OF EGYPT**
Farouk El-Baz and Hassan A. El-Etr (Ain Shams Univ., Cairo, Egypt) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 203-217 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The Western Desert of Egypt was selected for detailed study as a type locality of the north African desert environment. In addition to astronaut observations, 55 color photographs of Egypt were obtained during the Apollo-Soyuz mission using 70 and 35 mm cameras. These photographs showed regional and local color zones that were mapped and checked in the field. The Apollo-Soyuz color data were used in the selection of areas for field investigations and in the extrapolation of knowledge to unphotographed areas of the Western Desert. One of the results, the mapping of an arable zone west of the Nile Delta, attests to the potential value of color photographs in desert study. Author

**N80-10554*#** Smithsonian Institution, Washington, D. C.
**ORBITAL OBSERVATIONS OF SAND DISTRIBUTION IN THE WESTERN DESERT OF EGYPT**
Ann W. Gifford, Delia M. Warner, and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 219-236 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz Test Project photographs of the Western Desert of Egypt were studied to discover the usefulness of orbital imagery in delineating sand deposits. A strip of Apollo-Soyuz mapping-camera photographs was used to map sand distribution patterns. Information from this strip was extrapolated to the rest of Egypt using a falsecolor mosaic of LANDSAT images Author

**N80-11535#** Army Engineer Topographic Labs., Fort Belvoir, Va
**LAND COVER CLASSIFICATION FROM LANDSAT DATA: PHASE 3 OF A JOINT DOE/NASA DEMONSTRATION Final Report**
Richard N. Foreman Mar. 1979 84 p
(AD-A071723, ETL-0175) Avail: NTIS HC A05/MF A01 CSCL 14/5

The Corps of Engineers and NASA's Earth Resources Laboratory conducted a joint demonstration of the production of land cover classification data from LANDSAT data. This report describes Phase III of the demonstration, in which classification maps and data were produced for two Corps of Engineers Districts Wilmington District, an area in the upper Roanoke River basin of Virginia, and Jacksonville District, an area along the route of the Cross Florida Barge Canal. The report includes the Districts evaluations of the accuracy and applicability of the classifications and cost information for Phase III of the demonstration. The report also includes cost information for the application of interdisciplinary analysis of aerial photography as a means of obtaining land cover and environmental data. LANDSAT data may be cost-effective for identifying and showing the distribution of general types of land cover for large areas, although some land cover types may not be identifiable on a particular LANDSAT scene. Interdisciplinary analysis of aerial photography identifies and explains in a technical report the distribution of land cover. The extra detail of the report and the ability to ensure that specific land cover types are studied may make interdisciplinary analysis of aerial photography cost-effective for limited study areas GRA

**N80-11537#** Washington Univ., Seattle Remote Sensing Applications Lab
**STUDY IN REMOTE SENSING FOR LAND USE Final Report,**

**Apr. 1977 - Jun. 1978**
Richard D. Shinn and Frank V. Westerlund Air Force Engineering and Services Lab., Tyndall AFB, Fla. Jun. 1979 74 p refs
(Contract F08635-77-C-0278; AF Proj. 2103)
(AD-A071802; AFESC/ESL-TR-79-15) Avail: NTIS HC A04/MF A01 CSCL 14/2

This research tested three methods of obtaining land use information by remote sensing for United States Air Force (USAF) land use planning. The three methods tested were: (1) photo interpretation of aircraft photography; (2) equidensitometric processing of aircraft or LANDSAT imagery; and (3) statistical analysis of LANDSAT digital data. The two sites tested were McChord AFB and Fairchild AFB in Washington State. Using test scenarios of mission realignments it was found that photo interpretation was an accurate and ready means to obtain land use information. GRA

**N80-12484** Regionale Planungsgemeinschaft Utermain, Frankfurt (West Germany).
**FUTURE REMOTE SENSING TASKS IN REGIONAL PLANNING [ZUKUENFTIGE AUFGABEN DER FERNERKUNDUNG IN DER REGIONALPLANUNG]**
A. vonHesler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 183-186 In GERMAN

Avail: Issuing Activity

Remote sensing techniques when used at the beginning of a whole variety of projects can provide notable advantages. Country, regional and town planning activities have, up until now, because of increasing population characteristics, employed quantitative planning procedures. The need for qualitative planning is becoming increasingly apparent. Financial and administrative problems are ever present. The maximum efficiency in the use of the information so acquired is essential. Suggestions put forward include promoting the availability of DIBIAS systems among experimental workers, making aircraft flights more easily available and encouraging exchanges of information. Author (ESA)

**N80-12485** Ruhr Planning Authority, Essen (West Germany).
**INTERPRETATION OF IR AND MSS DATA FOR TOWN AREAS [INTERPRETATION VON IR- UND MSS-DATEN IM STADGEBEIT]**
F. H. Hirt and P. Stock *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 187-190 refs In GERMAN

Avail: Issuing Activity

While the classification of open spaces and areas of vegetation is relatively easy, it is difficult to identify building and other built-up area elements (such as houses, roads and automobile parks) as they are not associated with any precise spectral characteristics. A maximum likelihood method is used to separate vegetation, asphalt, rooftop and shade. Preliminary experiments using digital data processing suggest important new applications for town and regional planning in builtup areas. Author (ESA)

**N80-12517** Institut fuer Angewandte Geodaesie, Singlingen (West Germany).
**THE DETERMINATION OF LAND USAGES FOR PLANNING AND CARTOGRAPHY [DIE GEWINNUNG VON NUTZUNGSKATEGORIEN AUS MULTISPEKTRALEN ABTASTERAUFZEICHNUNGEN FUER PLANUNG UND KARTOGRAPHIE]**
K. Niemz *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 493-500 In GERMAN

Avail: Issuing Activity

Analog and digital processing of data for regional planning and small scale map production purposes is described. The analog procedure is used for applications with diazo layers in which color compositions are generated. The digital processing employs the DIBIAS system and the maximum likelihood method for classification. Ground maps are produced by both methods. Multispectral scanning and the classification of LANDSAT 2 data are treated. Examples are given covering the classification of a variety of crops. Author (ESA)

**N80-12524*#** Texas A&M Univ., College Station. Remote Sensing Center.
**APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report**
J. C. Harlan and D. W. Deering, Principal Investigators Sep. 1979 30 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20796)
(E80-10008; NASA-CR-162385; RSC-3018-7) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Rangelands in southwest Texas were used to establish threshold values and limitations on measuring herbaceous biomass under typical arid and semi-arid range conditions. Previous regression relationships established between ND6 and green biomass for two different ecosystems were similar. The west Texas data set for brush-free sites was too small to be statistically conclusive. It appears that a line with a third (and steeper) slope would be best for the west Texas data, and that line would intersect the other two. Results show that similar relationships exist between ND6 and green biomass under low brush canopy cover conditions, but local variations require a calibration to determine the best fit for an ecosystem. The brush canopy has a detrimental effect on the ND6 vs. herbaceous green biomass relationship.

**N80-12622*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A MULTISPECTRAL LOOK AT OIL POLLUTION DETECTION MONITORING AND LAW ENFORCEMENT**
Clarence E. Catoe and James T. McLean Oct. 1979 25 p refs
(NASA-TM-80573) Avail: NTIS HC A02/MF A01 CSCL 13B

The problems of detecting oil films on water, mapping the areal extent of slicks, measuring the slick thickness, and identifying oil types are discussed. The signature properties of oil in the ultraviolet, visible, infrared, microwave, and radar regions are analyzed. K.L.

**N80-13614#** National Technical Information Service, Springfield, Va.
**REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979**
Audrey S. Hundemann Aug. 1979 176 p Supersedes NTIS/PS-78/0789; NTIS/PS-77/0674
(NTIS/PS-79/0842/9; NTIS/PS-78/0789; NTIS/PS-77/0674) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarian problems. This updated bibliography contains 167 abstracts, 11 of which are new entries to the previous edition. GRA

**N80-13615#** National Technical Information Service, Springfield, Va.
**REMOTE SENSING APPLIED TO URBAN AND REGIONAL PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979**
Audrey S. Hundemann Aug. 1979 74 p Supersedes NTIS/PS-78/0790 and NTIS/PS-77/0675
(NTIS/PS-79/0843/7; NTIS/PS-78/0790; NTIS/PS-77/0675) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with and acting as an influence on health and physical well-being are included. This updated bibliography contains 65 abstracts, 2 of which are new entries to the previous edition. GRA

**N80-15626*#** Geological Survey, Reston, Va.
**CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report**
Robert H. Alexander, Prinicipal Investigator 26 Sep. 1979 384 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG; Proj. CARETS)
(E80-10031; NASA-CR-162442) Avail: NTIS HC A17/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

## 03

## GEODESY AND CARTOGRAPHY

Includes mapping and topography.

**A80-10172 #** **Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements (K voprosu o sovmestnom primenenii kartograficheskogo i aerokosmicheskogo metodov pri izuchenii noveishikh i sovremennykh tektonicheskikh dvizhenii).** V. I. Mikhailov (Belorusskii Politekhnicheskii Institut, Minsk, Belorussian SSR). *Geodeziia i Aerofotos'emka,* no. 3, 1979, p. 82-87. In Russian.

**A80-11695** **New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978.** Symposium sponsored by the International Society of Photogrammetry, Canadian Institute of Surveying, and Department of Energy, Mines and Resources. Ottawa, Canada, Canadian Institute of Surveying, 1979. 789 p. In English and French. $20.

**A80-11698 #** **Proposed parameters for an automated mapping satellite /MAPSAT/ system.** A. P. Colvocoresses (U.S. Geological Survey, National Center, Reston, Va.). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 374-382.

Landsats-1, 2, and 3, although not defined as mapping satellites, are in fact effectively recording the earth in a form suitable for presentation as small-scale image maps. These spacecraft have demonstrated the effectiveness of earth sensing, which must now move from the research to the operational phase. Landsat-D is designed to continue the research effort, but NASA, whose charter precludes operations, has not defined an operational system. An operational Landsat has previously been proposed in technical terms, but this concept was limited to the orthographic (two-dimensional) mode demonstrated by Landsat-1, 2, and 3. Mapping involves topography as well as planimetry, and a satellite compatible with the Landsat that also resolves the three-dimensional mode of topography is proposed. Such a satellite requires very high stability and pointing accuracy. The current state of the art permits such a satellite to be built and flown in a mode suitable for automated modeling of the earth's surface in three-dimensional as well as two-dimensional modes. The satellite would be complementary to or could be combined with the operational Landsat previously proposed, and it is suggested that it be designated the Automated Mapping Satellite or Mapsat. (Author)

**A80-11699 #** **The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications.** D. A. Cottrell and J. C. Maia (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 383-401. 19 refs.

The Brazilian Landsat program is reviewed with respect to geodetic support, future plans in cartographic applications, and ongoing mapping projects using Landsat data. Attention is given to a discussion of the software/hardware phases of the program. Illustrative examples are provided. Continued research along certain lines will provide a system to update existing survey and cartographic maps and refine thematic mapping productions over a wide range of land and water resources applications. S.D.

**A80-11701 #** **Concept for the automatic registration of satellite images with a digital map data base.** W. Kropatsch and F. Leberl (Graz, Technische Universität, Graz, Austria). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 411-424. 11 refs. Grant No. DA-ERO-78-G044.

The concept of a computer program system for automatic recording of digital satellite images using a digital cartographic data bank is described. This concept is developed on the basis of a survey of literature on image recording, on digital line detection, and on structural pattern recognition. The computer program system is basically modular so that additional features can be added, and it has a learning capability so that accumulated experience can improve its performance. The proposed system is described along with its various elements. The entire system is based on a digital image processing system called DIDAK which was developed for a general-purpose computer environment (Wiesel, 1977). Programming for this system is under way. S.D.

**A80-11702 #** **The practical contribution of space imagery to topographical mapping.** J. D. Leatherdale (Hunting Surveys, Ltd., Boreham Wood, Herts., England). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 425-444.

Space imagery is already making a practical contribution to topographical mapping at very small scales. Several examples of the use of Landsat, space photography and radar for mapping at scales between 1:1 million and 1:100,000 are described and illustrated. (Author)

**A80-11703 #** **Integration of LANDSAT CCT data and digital terrain data in cartographic application.** S. Murai and R. Tateishi (Tokyo, University, Tokyo, Japan). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 445-454.

The paper deals with integration of LANDSAT CCT data and digital terrain data in cartographic application. Geographic correction (scene correction) of LANDSAT MSS data with high accuracy which enables the overlay of LANDSAT data upon the national digital terrain model, automated relief shading using both LANDSAT data and digital terrain data, pseudo stereoscopic LANDSAT images and their three dimensional representation are major themes in the study. (Author)

**A80-11705 #** **Latin American experiences in utilizing satellite imagery for cartographic purposes.** J. E. Staples (Pan-American Institute of Geography and History, Mexico City, Mexico). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 474-483. 7 refs.

One of the new technologies being investigated and used to study and resolve earth resources and environmental problems is remote sensing. The Latin American cartographic institutions became aware of the potential of remote sensing technology and space-derived imagery together with the need for a multidisciplinary mapping approach, and since 1972 have experimented with satellite imagery to prepare cartographic products. In this paper attention is given to a review of the historical evolution of satellite imaging systems. During the 1981-1985 period, it is planned to place Landsat D in orbit with an advanced multispectral scanner. A 1:250,000 scale unified hemispheric map with unified data, grid systems, and similar symbology will provide earth resource and environmental scientists a cartographic and geographic base which can be used to yield the information necessary to their disciplines. S.D.

**A80-11706** # **Landsat imagery - A cartographic reference base.** W. M. Strome, E. A. Fleming, W. D. Bruce, and V. R. Slaney (Department of Energy, Mines and Resources, Ottawa, Canada). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978.
Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 484-502. 14 refs.

In recent years, the U.S. Landsat program has provided a small but continuing source of information for the production of new maps and the revision of existing maps for Canada. More recently, experiments have been conducted to examine the usefulness of new map products based on Landsat data. These are based on digitally enhanced and/or geometrically corrected MSS scenes. The discussion focuses on operational use of Landsat in mapping and on refining Landsat data for mapping. It is hoped that the derived maps will prove to be useful references for investigators in many disciplines. An assessment will be made by the Canadian Advisory Committee on Remote Sensing. If warranted by this evaluation and other comments received, additional maps may be produced in the future, with possible changes in format whenever necessary. S.D.

**A80-11709** # **Interactive analysis methods for resource mapping.** A. K. Turner (Environment Consultants, Inc., Lakewood, Colo.). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 735-754. 6 refs.

An interactive composite mapping system called GMAPS (General Map Analysis and Planning System), has been used to evaluate energy development plans, and make resource and environmental assessments. GMAPS is superior to the traditional transparent overlay methods because it is much cheaper, faster and more quantitative. Using GMAPS, variables and interactions can be easily modified to rapidly investigate an unlimited range of development alternatives. An associated mapping system GCARS, (Generalized Computer Aided Route Selection), can generate a set of alternative corridors between specified termini by applying linear programming methods to GMAPS models. The corridors are ranked for suitability according to environmental and socio-economic criteria. (Author)

**A80-15176** # **Method for increasing the accuracy of an airborne geodetic radio rangefinder (Metod povysheniia tochnosti samoletnogo geodezicheskogo radiodal'nomera).** A. I. Belov, A. M. Rasin, and L. S. Goldobina. *Geodeziia i Aerofotos'emka,* no. 4, 1979, p. 42-49. 5 refs. In Russian.

The paper analyzes the accuracy of an airborne two-antenna rangefinder, with a view to reducing errors associated with reflections from the underlying surface. Two components of range error are investigated: fluctuating and determinate. The analysis makes it possible to determine basic design and operational parameters for the rangefinder system. B.J.

**A80-15182** # **Standardization of cartographic field and aerial and space photography data for automatic map generation (Normalizatsiia kartograficheskikh polevykh i aerokosmicheskikh materialov dlia avtomaticheskogo postroeniia kart).** E. E. Shiriaev (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka,* no. 4, 1979, p 81-85. In Russian.

The paper describes a method for preparing cartographic data for automatic processing with a view to automated map generation. A data standardization procedure, based on optimal division of functions between man and machine, is proposed for various scanning systems. B.J.

**A80-16560** # **Structure of taiga landscapes and its study by remote sensing techniques (Struktura taezhnykh landshaftov i metody ee distantsionnogo izucheniia).** D. M. Kireev. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 11-44, 185. 9 refs. In Russian.

The applications of remote sensing to the study of taiga landscapes is demonstrated by the example of a region in western Siberia. Landscapes and land forms are identified by the method of ecological indicators using land forms of various scales. Landscape and morphological studies, in conjunction with analyses of thematic maps, confirmed the correctness of natural territorial identifications on a structural-morphological basis. V.P.

**A80-16561** # **Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography (Printsipy izucheniia gornykh lesnykh landshaftov basseina oz Baikal s ispol'zovaniem aerokosmicheskikh snimkov).** N. I. Rubstov. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 45-59, 186-189. 10 refs. In Russian.

**A80-17403** * **Earth feature identification and tracking technology development.** R. G. Wilson and W. E. Sivertson, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Smart sensors; Proceedings of the Seminar, Washington, D.C., April 17, 18, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 185-194. 37 refs.

The paper discusses needs for smart sensing in terrestrial and atmospheric remote sensing as related to current technology and a scheduled Shuttle experiment. An approach is outlined involving Shuttle-borne experiments to develop earth feature identification and tracking technology including a Feature Identification and Location Experiment (FILE) scheduled for flight on the NASA Shuttle with an objective of classifying earth features into categories of bare land, water, vegetation, and clouds, snow, and ice. The plan for evolution of the FILE-related technology leads to capabilities for pointing instruments to predetermined sites, reacquiring earth features or landmarks, and tracking features such as coastlines and rivers. Technology concepts relative to an overall system transfer function is discussed, and the development status outlined. A.T.

**A80-20200** # **Recording the contour of a region with an airborne laser profilograph (Registratsiia rel'efa mestnosti s pomoshch'iu lazernogo aviaprofilografa).** A. G. Kuliasov, L. E. Marasin, Iu. V. Popov, S. A. Sokolov, V. I. Solodukhin, I. N. Mazhugin, A. Ia. Zhukov, and V. I. Narkevich. *Geodeziia i Kartografiia,* Oct. 1979, p. 40-42. In Russian.

In the study described, a phase-type profilograph employing an He-Ne laser and an interference filter with a passband of 15 A was used onboard an aircraft to record the contours of a factory and a wooded slope. The profilograph was found to provide contour recordings, not only of a wooded area but also of the underlying earth surface, with a high resolution with respect to height. V.P.

**A80-20253** * **An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy.** C. O. Justice (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 303-328. 29 refs.

The paper deals with the method and results of a study which involved an examination of the statistical relationships between selected ground properties and Landsat MSS data, and whose aim was to assess the applicability of Landsat data to surface cover mapping in areas characterized by high-frequency spatial variations of surface cover type over small areas. The results indicate that by systematic ground data collection it is possible to understand the basic relationships between ground properties and Landsat sensor data in areas of complex surface cover and terrain, and to classify the cover types. V.P.

**N80-10556*#** Smithsonian Institution, Washington, D. C.
**TEMPORAL CHANGES AS DEPICTED ON ORBITAL PHOTOGRAPHS OF ARID REGIONS IN NORTH AFRICA**
Marie H. Slezak and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 263-272 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

Processes typical of arid environments can be monitored from space by comparing orbital photographs taken over a period of years. Oblique photographs can be used, but best results are obtained with vertical or near-vertical photographs. Changes observed by comparing the 1975 Apollo-Soyuz photographs with data from previous missions include (1) an increase in vegetation west of the Nile Delta of approximately 1108 sq km in 10 years; (2) an average shift of 2.5 km over a 6 year period in the sand patterns of the Oweinat Mountain region at the borders between Egypt, Libya, and Sudan; and (3) a reduction in the water level of Lake Chad and dune encroachment upon the lake over a period of 9 years. R.E.S.

**N80-14443#** Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.
**PHYSICAL BACKGROUND OF REMOTE SENSING**
W. D. Langeraar *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 14-19

Avail: NTIS HC A09/MF A01

The physical principles of remote sensing are reviewed. After a brief discussion of the evolution of sensory data acquisition and interpretation, instruments, such as infrared detectors, seismometers, geiger-counters, and magnetometers, are considered. Emphasis is on the role of electromagnetic radiation in the detection of signals which would otherwise not be perceivable by human senses. Multispectral scanning data, like that available from LANDSAT, is taken as an example and spectral signatures are discussed. Finally, the spectral bands utilized by METEOSAT are also briefly treated. Author (ESA)

**N80-14462#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**ON THE USE OF DIGITAL PHOTOGRAMMETRIC MEASUREMENTS IN THE COMPILATION OF TOPOGRAPHIC MAPS [BEITRAEGE ZUR DIGITALEN PHOTOGRAMMETRISCHEN MESSUNG FUER DIE HERSTELLUNG TOPOGRAPHISCHER KARTEN]**
Hermann G. Neubauer 1978 125 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(Ser-1-Original-Rept-76) Avail: NTIS HC A06/MF A01

The preparation of topographic maps is discussed. The technique where topographic maps are first prepared in the form of graphic manuscripts by applying photogrammetric methods is briefly reviewed. It is shown that attempts at a rationalization of map production leads, with the aid of digital data, to automated procedures. The measurements, the computations by means of electronic data processing equipment, and the output of field comparison documents are discussed. Author (ESA)

**N80-14603*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**SYSTEM FOR REAL-TIME CRUSTAL DEFORMATION MONITORING Patent**
Peter F. MacDoran, inventor (to NASA) (JPL) Issued 9 Oct. 1979 7 p Filed 21 Dec. 1977 Supersedes N78-17529 (16 - 08, p 1043) Sponsored by NASA
(NASA-Case-NPO-14124-1; US-Patent-4,170,776;
US-Patent-Appl-SN-863024; US-Patent-Class-343-112D;
US-Patent-Class-343-100ME) CSCL 08G

A system is described for use in detecting earth crustal deformation using an RF interferometer technique for such purposes as earthquake predictive research and eventual operational predictions. A lunar based RF transmission or transmissions from earth orbiting satellites are received at two locations on Earth, and a precise time dependent phase measurement is made of the RF signal as received at the two locations to determine two or three spatial parameters of the antenna relative positions. The received data are precisely time tagged and land-line routed to a central station for real-time phase comparison and analysis. By monitoring the antenna relative positions over an extended period of months or years, crustal deformation of the Earth can be detected.
Official Gazette of the U.S. Patent and Trademark Office

**N80-14605** Washington Univ., Seattle.
**CRUSTAL DEFORMATION IN CENTRAL CALIFORNIA: MULTI-WAVELENGTH GEODETIC OBSERVATIONS AND INTERPRETATIONS Ph. D. Thesis**
John Oliver Langbein 1979 213 p
Avail: Univ. Microfilms Order No. 7927822

A precision geodetic experiment was conducted on a segment of the Calaveras fault near Hollister, Calif., which had been previously instrumented for surface creep. The experiment utilized a multi-wavelength distance measuring (MWDM) device which produced daily distance determinations of nine baselines ranging from 3 to 9 km in length with a measurement precision approaching 0.1 micron strain. Analysis of the MWDM data reveals the following: (1) Long-term trends over the 2-1/2 years sampled are consistent with rigid block displacement across the Calaveras fault zone. (2) The present strain release mechanism appears to be episodic aseismic slip on the Calaveras fault with a characteristic time of about one month. (3) Maximal inversion of the baseline displacement shows that Calaveras slip episodes could result from either a small amount of slip distributed over a large fault area or a large amount distributed over a small fault area. Dissert. Abstr.

**N80-15446*#** Lamont-Doherty Geological Inst., Palisades, N. Y.
**SHAPE OF THE OCEAN SURFACE AND IMPLICATIONS FOR THE EARTH'S INTERIOR: GEOS-3 RESULTS**
M. E. Chapman, M. Talwani, H. Kahle, and J. H. Bodine Wallops Flight Center, Wallops Island, Va. NASA Nov. 1979 189 p refs
(Contract NAS6-2519)
(NASA-CR-156859) Avail: NTIS HC A09/MF A01 CSCL 08G

A new set of 1 deg x 1 deg mean free air anomalies was used to construct a gravimetric geoid by Stokes' formula for the Indian Ocean. Utilizing such 1 deg x 1 deg geoid comparisons were made with GEOS-3 radar altimeter estimates of geoid height. Most commonly there were constant offsets and long wavelength discrepancies between the two data sets; there were many probable causes including radial orbit error, scale errors in the geoid, or bias errors in altitude determination. Across the Aleutian Trench the 1 deg x 1 deg gravimetric geoids did not measure the entire depth of the geoid anomaly due to averaging over 1 deg squares and subsequent aliasing of the data. After adjustment of GEOS-3 data to eliminate long wavelength discrepancies, agreement between the altimeter geoid and gravimetric geoid was between 1.7 and 2.7 meters in rms errors. For purposes of geological interpretation, techniques were developed to directly compute the geoid anomaly over models of density within the Earth. In observing the results from satellite altimetry it was possible to identify geoid anomalies over different geologic features in the ocean. Examples and significant results are reported. R.C.T.

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# 04

# GEOLOGY AND MINERAL RESOURCES

**Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.**

**A80-16427** * # **Geodynamics from satellites.** W. M. Kaula (California, University, Los Angeles, Calif.). *American Astronautical Society, Annual Meeting, Los Angeles, Calif., Oct. 29-Nov. 1, 1979, Paper 79-243.* 6 p. 6 refs. Grant No. NsG-5263.

The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geomagnetics and earthquake hazard reduction. Global tectonics are to be observed by satellite laser tracking and radio interferometry, which will be used to measure the movements of extended (greater than 200 km) regions to an accuracy of 3 cm, while for shorter distances, lasers enable a more rapid measuring of regional strain accumulation patterns than ground systems. The techniques of Doppler tracking between two satellites to measure the gravity field over the ocean is also under NASA study. J.P.B.

**A80-14373 Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district (Terrestrische und aerophotogrammetrische Vermessung grosser Tagebaue im Rheinischen Braunkohlenrevier).** K. Reichenbach (Rheinische Braunkohlenwerke AG, Cologne, West Germany). *Bildmessung und Luftbildwesen,* vol. 47, Nov. 1, 1979, p. 173-178. 11 refs. In German.

**A80-20258** * **Long wavelength radar for geological analysis in vegetated terrain.** H. C. MacDonald, W. P. Waite, D. N. Tolman, and M. Borengasser (Arkansas, University, Fayetteville, Ark.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1978, p. 386-394. Contracts No. JPL-954940; No. JPL-955048.

In contrast to shorter wavelength radars, the range of returns from vegetated surfaces is appreciably less at L-band frequencies. However, the evaluation of differences in image quality due to changes in operational frequency is hindered by several system dissimilarities. In particular, a comparison of the Ka, X- and L-band radar imagery is difficult because of differences in 'effective' resolution. Though the physical resolution of these systems may be somewhat comparable, the inherent averaging of the real aperture systems (X-and Ka-) provides an apparent wider range of gray tones. This effect is related to the fact that at a scale where the resolution cell is discernable, the coherent scintillation of 'speckle' of the synthetic aperture L-band system masks tonal variations. This mismatch of effective resolution impedes detection of small changes in gray tone and makes subtle boundary changes less distinct. V.P.

**N80-10540*#** California Inst. of Tech., Pasadena.
**GEOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF PARTS OF SOUTHERN CALIFORNIA**
R. E. Powell and L. T. Silver *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 9-27 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

Tectonic interpretations of the geologic features of the San Andreas, San Gabriel, and San Jacinto faults are discussed. F.O.S.

**N80-10542*#** Amherst Coll., Mass.
**EVALUATION OF SATELLITE IMAGES OF THE LEVANTINE RIFT ZONE**
Richard M. Foose *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 37-43 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Structural and lithologic features along the Levantine Rift zone were mapped using satellite images from three sources: LANDSAT, Skylab, and Apollo-Soyuz. The accuracy and completness of these maps were checked during January 1977 on a field trip from the southern end of the Gulf of Elat to the Israeli-Syrian border. Specific structural features and regional tectonic relationships along the zone were clearly displayed on all images. In certain instances, the oblique photographs from Apollo-Soyuz were superior; but, in most cases, the vertical images from LANDSAT provided more complete and accurate relationships. The analysis of tectonic features mapped on space images concurrent with geologic mapping in the field provides an improved basis for understanding the tectonic evolution of large regions. Author

**N80-10543*#** Texas Univ. at Austin.
**ANALYSIS OF SKYLAB AND ASTP PHOTOGRAPHS OF THE LEVANTINE (DEAD SEA) FAULT ZONE**
W. R. Muehlberger, L. K. Goetz, and R. C. Belcher *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 45-62 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

Manned-spacecraft photographs of the Dead Sea Rift Zone (DSRZ) were studied to evaluate the fault zone. The interpretation shows a splintering of the DSRZ toward the East Anatolian Fault Zone. This splintering deranged modern drainage systems, which indicates that this region is tectonically active, and these faults constitute a major earthquake hazard. F.O.S.

**N80-10544*#** Missouri Univ. at Rolla.
**ANALYSIS AND SYNTHESIS OF SPACE IMAGERY OF THE SOUTHEASTERN-TURKEY/NORTHWESTERN-IRAN MOBILE BELT**
Paul Dean Proctor, Douglas C. Melton, Jr., Ali Beken (Middle Eastern Technical Univ., Ankara, Turkey), and L. K. Abrams *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 63-85 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz photographs and LANDSAT images of eastern Turkey and northwestern Iran were analyzed for major geological features to develop a regional tectonic map. The analysis revealed three major geological terrains: an autochthonous block of folded layered rocks; and allochthonous block of older, more uniform rocks with folds and faults; and a volcanic terrain. F.O.S.

**N80-10545*#** Ain Shams Univ., Cairo (Egypt).
**STRUCTURAL PATTERN OF THE NORTHERN PART OF THE EASTERN DESERT OF EGYPT**
Mohamed A. Abdel-Rahman and Hassan A. El-Etr *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 87-96 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz color photographs of the northern part of the eastern desert of Egypt were excellent for regional structural mapping because of their color fidelity and large areal coverage. The oblique Apollo-Soyuz photographs were used for the identification of faults, whereas enlarged LANDSAT images were used for planimetric mapping. Aerial photographs were also examined to verify the mapped fault lines, and it was revealed that several of the lines detected on Apollo-Soyuz photographs were, in fact, zones of narrowly spaced, parallel faults. The results suport the contention that vertical tectonics were responsible for the development of the fault pattern of the area. J.M.S.

**N80-10546*#** Ain Shams Univ., Cairo (Egypt).
**PHOTOLINEAMENTS IN THE ASTP STEREOSTRIP OF THE WESTERN DESERT OF EGYPT**
Hassan A. El-Etr, Adel R. Moustafa, and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 97-105 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

Photolineaments displayed on the Apollo-Soyuz stereostrip covering part of the western desert of Egypt were studied. Virtually all of the photolineaments detected on LANDSAT images (black-and-white as well as false-color composites) were also detected on Apollo-Soyuz photographs of the same scale and approximately the same resolution. The drawbacks of Apollo-Soyuz photographs include (1) the low base/height ratio, which limited the effective stereovision; (2) the high sun-elevation angle, which limited the shadows required to easily identify linear features; and (3) the overexposure of the central parts of the frames, particularly over the Great Sand Sea. Recommendations are made to remedy this on future earth-orbital photographic missions.
J.M.S.

**N80-10547*#** Ain Shams Univ., Cairo (Egypt).
**UTILIZATION OF ASTP PHOTOGRAPHS IN THE STUDY OF SMALL STRUCTURES IN ABU RAWASH AND WADI EL NATRUN, EGYPT**
Hassan A. El-Etr and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 107-118 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Geologic structures of the northern part of the western desert of Egypt were studied utilizing enlargement of Apollo-Soyuz Test Project color photographs. The Apollo Soyuz photographs of Abu Rawash clearly show structural uplifts that brought white chalk deposits to the surface, depict the distribution of dark volcanic rocks in the region, and clearly delineate complex structures including several domes and plunging anticlines. The Apollo Soyuz photographs of Wadi el Natrun display its structures as well as the string of salt lakes within it and the barren nature of the northern and southern extremities of the depression. The photographs reveal that there is a potential for increasing the area of cultivated land on the eastern slope of the depression.
J.M.S.

**N80-10548*#** Missouri Univ. at Rolla.
**PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES**
Paul Dean Proctor, Kenneth B. Horrall, Douglas C. Melton, Jr., and David F. Thompson *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 119-148 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The tectonic characteristics of southeastern Spain were analyzed using the Apollo Soyuz Test Project oblique color photographs and LANDSAT vertical images. Four distinct tectonic provinces were identified along with three orders of fold dimensions and two orders of lineaments. Both thrust faults and normal were shown to occur in the region. A discussion of the geologic setting of southeastern Spain is given along with the results of the phototectonic analysis. J.M.S.

**N80-10549*#** Ain Shams Univ., Cairo (Egypt).
**EAST-WEST PERVASIVE LINEAMENTS IN CENTRAL AND SOUTHEASTERN SPAIN**
Mohamed A. Abdel-Rahman *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 149-156 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The lineament pattern of central and southeastern Spain was detected on photographs taken during the Apollo-Soyuz mission. The obliquity of these photographs made possible the recognition of previously unnoticed structures. The true color of the photographs also aided in identifying the lineaments. Statistical analysis indicated that the lineament pattern was not random and must be caused by geological factors. Three lineament trends were identified. In decreasing order of significance, these were east-west, northeast, and northwest. Faults in this region were traced from a geological map, and their strikes were analyzed and found to include two preferred orientations, a northeasterly trend and a west-northwesterly trend; the first trend was more prominent. Author

**N80-10550*#** Missouri Univ. at Rolla.
**PHOTOGEOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF THE LAKE TORRENS-FLINDERS RANGES-LAKE BLANCHE AREA, SOUTH AUSTRALIA**
Paul Dean Proctor and Robert Sickler *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

Excellent ASTP color prints and transparencies of the North Flinders Ranges and the adjacent Lake Torrens-Lake Blanche basin areas of South Australia were analyzed to determine the characteristics of the regional fold structures. Major folds, faults, and other lineaments were identified. Tectonic patterns and their relationships to mobile belt-plate tectonics were examined. In addition, basin forms and features were analyzed and related to the desert environment of the area. Possible rock types and the character of the widespread alluvial materials surrounding the bedrock areas were predicted. An interpretive photogeologic map covering the area of the ASTP photographs was produced.
J.M.S.

**N80-10551*#** Arizona State Univ., Tempe.
**VOLCANIC LANDFORMS AND ASTROBLEMES**
R. S. Dietz and J. F. McHone (Illinois Univ. at Urbana-Champaign) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 183-202 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

Apollo crewmembers, while searching for circular ground features, observed and photographed astroblemes (ancient impact scars) in Brazil and Libya, and volcanoes in Italy, the Galapagos Islands, and Mexico. The Brazilian site was previously unknown to impact scientists, and photographic measurements of the Libyan structure proved larger than measurements made by earth-based investigators. Plumes of active volcanoes in Italy were traced great distances, and the inaccessible Galapago Islands were viewed synoptically. In Mexico, a feature that had been previously identified as a possible meteorite impact site was found to be formed by a volcanic steam explosion. Author

**N80-10552*#** Illinois Univ. at Urbana-Champaign.
**RIACHAO RING, BRAZIL: A POSSIBLE METEORITE CRATER DISCOVERED BY THE APOLLO ASTRONAUTS**
J. F. McHone *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 193-202 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

In north-central Brazil, the Apollo crewmembers photographed a 4 km wide circular ground pattern. Although the feature was not visible on airborne radar and in near-infrared satellite images, it was clearly seen from space in the visible part of the spectrum. A ground reconnaissance of this location and of a second circular structure nearby strongly supports a meteoritic origin for both sites. Author

**N80-10555*#** Smithsonian Institution, Washington, D. C.
**PRELIMINARY ANALYSIS OF COLOR VARIATIONS OF SAND DEPOSITS IN THE WESTERN DESERT OF EGYPT**
Farouk El-Baz, Marie H. Slezak, and Ted A. Maxwell *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 237-262 refs
Avail: NTIS HC A99/MF A01 CSCL 08G

Astronaut observations and photographs of color variations in the Western Desert of Egypt are related to both iron oxide coating on individual grains and the presence of locally derived material in the sand deposits. The northern region of the Western

Desert has the highest percentage of calcareous grains originating from local limestone outcrops. Samples from the central part of the Western Desert contain numerous iron-rich grains originating from the iron deposits of Bahariya and are locally enriched in shale fragments from the Dakhla Shale. Sands of the Great Sand Sea are relatively homogeneous, quartz-rich deposits that vary little in percentage of minor components.
R.E.S.

**N80-10557*#** Smithsonian Institution, Washington, D. C.
**ASTP PHOTOGRAPHS OF SOUTHEASTERN ANGOLA**
Delia M. Warner *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 273-283 refs

Avail: NTIS HC A99/MF A01 CSCL 08B
Apollo-Soyuz photographs of southeastern Angola were studied to provide a preliminary description of landforms in this remote and sparsely populated region. These photographs were useful in distinguishing drainage patterns, lineament trends, rock types, and the distribution of unusual play-like features. Author

**N80-10558*#** Smithsonian Institution, Washington, D. C.
**COLOR OF DESERT SURFACES IN THE ARABIAN PENINSULA**
Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 285-299 refs

Avail: NTIS HC A99/MF A01 CSCL 08G
A detailed analysis of the Apollo-Soyuz photographs is presented. The following facts were established: (1) available charts and maps can be updated using the orbital photographs, particularly of coastal zones; (2) geologic maps can be improved by use of the natural color photographs, which clearly delineate major geologic features and their characteristics; (3) the photographs can be used in characterizing sand fields and classifying dune forms; and (4) enlargements of the photographs can be useful in detailed studies of small areas, such as the city of Ad Dawhah (Doha), Qatar, and its environs.
M.M.M.

**N80-10559*#** Smithsonian Institution, Washington, D. C.
**MONTE DESERT OF SAN JUAN, ARGENTINA, AS PHOTOGRAPHED BY ASTP**
Delia M. Warner and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 301-318 refs
Avail: NTIS HC A99/MF A01 CSCL 08B
The photographs by the ASTP reveal that the physiographic setting of the study area is characterized by mountain-and-bolson topography controlled mainly by faulting. Most of the lineaments detected on the photographs appear to correspond to faults, and some of them may provide evidence of recent fault movement in the area. Typical topographic features include barren, deeply dissected block mountains bordered by slopes of alluvial materials that descent to a flat-floored desert basin. M.M.M.

**N80-10560*#** Geological Survey, Flagstaff, Ariz.
**DUNES AND OTHER WINDFORMS OF CENTRAL AUSTRALIA, AND A COMPARISON WITH LINEAR DUNES ON THE MOENKOPI PLATEAU, ARIZONA**
C. S. Breed and W. J. Breed (Museum of Northern Arizona, Flagstaff) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 319-358 refs

Avail: NTIS HC A99/MF A01 CSCL 08G
Internal structures of linear dunes that were examined in central Australia and in northern Arizona are mainly medium-scale, thin cross-beds or cross-laminae with dips commonly less than 20 deg. Astronauts aboard the Apollo spacecraft identified the same hue, chroma, and value of red sand in dunes of central Australia that ground survey teams found in the main body of the Simpson Desert. Ground examination confirms that within each field of dunes, relative degrees of redness can help discern sequences of depositional events in that area (given a uniform sand supply and climatic zone). It was concluded that reconnaissance from space is ideal for identifying key sites for field studies of specific geomorphic problems in remote desert regions.
M.M.M.

**N80-10571*#** Ain Shams Univ., Cairo (Egypt).
**DETECTION OF A PROBABLE ANCESTRAL DELTA OF THE NILE RIVER**
Mohamed A. Abdel-Rahman and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 511-520 refs

Avail: NTIS HC A99/MF A01
Interpretation of a near vertical Apollo Soyuz photograph of the present Nile Delta in northern Egypt is presented. The interpretation determines an ancestral delta of the Nile River. The limits, shape, position, and age of the ancestral Nile Delta are identified. The mineralogy of the delta is reported and the geochemistry data is analyzed. A.W.H.

**N80-11527#** Joint Publications Research Service, Arlington, Va.
**GEOPHYSICS, ASTRONOMY AND SPACE, NO. 450**
2 Aug. 1979 47 p refs Transl. into ENGLISH from selected Russian articles
(JPRS-73946) Copyright. Avail: NTIS HC A03/MF A01
Articles concerning the earth's crust under the ocean, and the upper atmosphere are reported.

**N80-12482** Technische Universitaet, Munich (West Germany).
**QUANTITATIVE DETERMINATION OF MORPHOLOGICAL STRUCTURES IN SAND BANK REGIONS FROM IMAGE STRUCTURE ANALYSIS [QUANTITATIVE ERFASSUNG MORPHOLOGISCHER STRUKTUREN IN WATTGEBIETEN DURCH ANWENDUNG VON VERFAHREN DER BILDSTRUKTURANALYSE]**
U. Wieczorek *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 153-164 refs In GERMAN

Avail: Issuing Activity
Several factors must be taken into consideration: variations in the altitude of the sun, the position of the object in the image field, the release of residual water from the sand bank's surface, drying out of the sand bank, and relief characteristics (micro, intermediate and macro features). Surface and texture variations are discussed. The way in which the problems encountered are overcome is described together with the computerized treatment of the data obtained. Examples are given. Author (ESA)

**N80-12483** Technische Universitaet, Munich (West Germany).
**MAKING MORPHOLOGICAL MAPS OF SAND BANKS FROM AERIAL PHOTOGRAPHS [MORPHOLOGISCHE WATTKARTIERUNG NACH LUFTBILDERN]**
C. Franke *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 165-182 refs In GERMAN

Avail: Issuing Activity
Different current distribution and direction regions can be distinguished in aerial photographs of water sand banks. These regions correspond to different sedimentary dispositions of the sand bank surfaces. The materials and methods used are described together with the interpretation of color and texture characteristics. Studies of the Crildumensiel sand banks are treated in detail; the corresponding are given and interpreted. Author (ESA)

**N80-12521*#** Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.
**GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Jun. - 31 Aug. 1979**

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Aug. 1979 14 p Sponsored by NASA ERTS
(E80-10005; NASA-CR-162382) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-13612#** National Technical Information Service, Springfield, Va.
**REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Jul. 1979**
Audrey S. Hundemann Aug. 1979 189 p Updates NTIS/PS-76/0500 Supersedes NTIS/PS-78/0791; NTIS/PS-77/0676
(NTIS/PS-79/0844/5; NTIS/PS-78/0791; NTIS/PS-77/0676) Avail: NTIS HC $28.00/MF $28.00 CSCL 08G

The use of LANDSAT satellites and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. This updated bibliography contains 180 abstracts, 33 of which are new entries to the previous edition. GRA

**N80-13613#** New Mexico Univ., Albuquerque. Technology Application Center.
**REMOTE SENSING APPLIED TO GEOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jun. 1979**
Gerald F. Zollars Aug. 1979 53 p Sponsored by NTIS
(NTIS/PS-79/0822/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 08G

This bibliography cites 215 articles concerning LANDSAT images, satellite-borne photography, aerial photography, and radar techniques being used to conduct geological surveys. Articles concerning photomapping and photo interpretation techniques relating to resource exploration are stressed. GRA

**N80-15528*#** Stanford Univ., Calif. School of Applied Earth Sciences.
**GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Progress Report, 1 Jul. - 30 Sep. 1979**
R. J. P. Lyon and A. E. Prelat, Principal Investigators 30 Sep. 1979 2 p ERTS
(Contract NAS5-24232)
(E80-10033; NASA-CR-162444) Avail: NTIS HC A02/MF A01 CSCL 08G

**N80-15529*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1979**
Helen N. Paley, Anne B. Kahle, and Stuart E. Marsh, Principal Investigators Nov. 1979 5 p ERTS
(Contract NAS7-100)
(E80-10035; NASA-CR-162446) Avail: NTIS HC A02/MF A01 CSCL 08G

# 05
# OCEANOGRAPHY AND MARINE RESOURCES

**Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.**

**A80-10116** **Optical methods for investigating oceans and inland basins (Opticheskie metody izucheniia okeanov i vnutrennikh vodoemov).** Edited by G. I. Galazii (Akademiia Nauk SSSR, Limnologicheskii Institut, Listvenichnoe, USSR) and K. S. Shifrin (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). Novosibirsk, Izdatel'stvo Nauka, 1979. 373 p. In Russian.

The book deals with the application of visible and infrared optical methods to the study of oceans and inland waters. Some aspects of oceanographic optics and remote sensing are examined, along with the color and spectrum of the outgoing light as a means of evaluating the oceanic chlorophyll and suspensions. Optical methods of studying swell, pollution, and radiation temperature are outlined. V.P.

**A80-10731 * #** **New developments in satellite oceanography and current measurements.** N. E. Huang (NASA, Wallops Flight Center, Wallops Island, Va.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Oct. 1979, p. 1558-1568. 175 refs.

Principal satellite remote sensing techniques and instruments are described and attention is given to the application of such techniques to ocean current measurement. The use of radiometers, satellite tracking drifters, and altimeters for current measurement is examined. Consideration is also given to other applications of satellite remote sensing in physical oceanography, including measurements of surface wind stress, sea state, tides, ice, sea surface temperature, salinity, ocean color, and oceanic leveling. B.J.

**A80-11750 #** **Use of satellites in polar meteorology (Utilisation de satellites en météorologie polaire).** A. Poggi (CNRS, Laboratoire de Glaciologie, Grenoble, France). In: Data collection and location by satellite; Workshop on ARGOS Utilization, Toulouse, France, March 28, 29, 1979, Proceedings.
Toulouse, Centre National d'Etudes Spatiales, 1979. 5 p. 16 refs. In French.

The study of atmosphere-ice-ocean interaction in East Antarctica which will use newly developed satellite systems is presented. In particular, the ARGOS system will provide quick access to data transmitted by platforms deployed on the Antarctic continent over an area bordered by the Terre Adelie coast and extending 1000 km inland. The Landsat imagery will be used to study pack ice, and the Nimbus meteorological satellite data will be utilized to characterize the lower troposphere over the area under study. It will also determine ice surface temperatures and the radiation balance, but the platform data (surface pressure and temperature) may also be used as a reference for the correction of satellite information. A.T.

**A80-13129 *** **Chlorophyll gradient map from high-altitude ocean-color-scanner data.** H. H. Kim, C. R. McClain (NASA, Goddard Space Flight Center, Greenbelt, Md.), and W. D. Hart (Science Systems and Applications, Inc., Lanham, Md.). *Applied Optics,* vol. 18, Nov. 15, 1979, p. 3715, 3716.

A chlorophyll density map of an ocean area 25 x 30 km is presented, and the procedure used in generating the map from high-altitude ocean-color-scanner data is discussed. Data were obtained from a ten-channel radiometer on board a U-2 aircraft flying at 19.8 km above the coastal waters of Monterey Bay, California under conditions of clear skies and clear and deep water; the processing algorithms should be useful for satellite data as well. The total radiance measured at high altitude was separated into an atmospheric and sea-surface component and a water component, which is associated with chlorophyll content, for each pixel using the upwelling radiance of a near IR channel to estimate the atmospheric effect. Chlorophyll data were extracted by taking the ratio of the difference of intensities in the 472 and 506 nm channels to the sum of the channels, and are found to agree with shipboard chlorophyll determinations at a depth of 5 m. A.L.W.

**A80-14467 * #** **Synthetic aperture radar imaging of moving ocean waves.** C. T. Swift (NASA, Langley Research Center, Hampton, Va.) and L. R. Wilson. *IEEE Transactions on Antennas and Propagation,* vol. AP-27, Nov. 1979, p. 725-729. 8 refs.

A theory for the radar imaging of ocean waves is presented under the assumptions that a swell propagates through an ensemble of Bragg scatterers and that the integration time of the synthetic aperture radar (SAR) is small compared to the angular velocity of the swell. Results are presented which show image development and distortions caused by the radial velocities and accelerations of the swell. Neglecting small wave bunching and tilts due to the longer underlying waves, and considering only one-dimensional geometries, the mechanism of wave motions are considered and their efforts on the production of the usual intensity pattern representing the wave image are studied. The analysis shows that in certain situations a processed image can appear which has twice the spatial period of the actual long wave on the ocean, which can confuse the interpretation of ocean wave analysis. (Author)

**A80-20260** **Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey.** C. E. Ogrosky (Rutgers University, New Brunswick, N.J.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 423-430. 14 refs. NOAA-supported research.

Cost-effective methods for an aerial inventory of submerged beds of vegetation 2 hectares or more in area using 35 mm film/filter/exposure combinations and the effects of environmental conditions on image interpretability were developed. Ektachrome 200 Professional (daylight) and Ektachrome IR film were tested, where the natural color Ektachrome 200 film with Wratten No. 4 or 8 filtration, exposed at + 1 or + 2 f-stop(s) at an altitude of 1500 m, gave reasonable image densities and target definition of 1:27000 scale transparencies, making possible the detection of submerged vegetation at depths of up to 2 m in the highly turbid waters. The mapped distribution of submerged beds in a test area correlated well with ground truth data, demonstrating the potential usefulness of aerial photographic methods for the delineation of marine plant resources in a comprehensive statewide estuarine survey. (Author)

**A80-20938** **The structure and variability of shelf sea fronts as observed by an undulating CTD system.** C. M. Allen (Liverpool, University, Liverpool, England), J. H. Simpson (Marine Science Laboratories, Anglesey, Wales), and R. M. Carson (Nairobi, University, Nairobi, Kenya). *Oceanologica Acta,* vol. 3, Jan. 1980, p. 59-68. 18 refs.

Detailed observations of the structure of shelf sea fronts have been made by means of an undulating towed CTD. The high resolution data reveal a complex pattern of variability in both space and time; seasonal development and the effects of wind stirring on the frontal structure are also illustrated. An estimate of the variation in the efficiency of tidal mixing, e, on the basis of the observed potential energy, (V), distribution is suggestive of a positive feedback process in the establishment of stratification. Such a process would be consistent with recent observations which show that the fronts do not adjust significantly during the spring-neaps cycle as predicted by the vertical mixing model of James (1977). (Author)

**A80-15893** **Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar.** W. A. Sandham, E. D. R. Shearman, and D. J. Bagwell (Birmingham, University, Birmingham, England). In: International Conference on Antennas and Propagation, London, England, November 28-30, 1978, Proceedings. Part 2. London, Institution of Electrical Engineers, 1978, p. 1-5. 7 refs. Research supported by the Science Research Council.

The potential of ground-wave radar with high-resolution spectral analysis for sea-state sensing and surface current measurements is outlined and some experiments with a MF radar on a peninsular site in the UK are presented. Analysis of the observations made with an omnidirectional antenna shows that at such a site, ground attenuation limits the sector of ocean surveyed. Directional observations were made by two synthetic aperture techniques. A new technique using synthetic aperture measurements and bistatic geometry is also briefly discussed. V.T.

**A80-16247** **Gulf stream boundary eddies off the east coast of Florida.** F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King (Research Triangle Institute, Research Triangle Park, N.C.). *Journal of Physical Oceanography*, vol. 9, Nov. 1979, p. 1214-1222. 11 refs. Contract No. EF-77-C-05-05444.

Satellite infrared data and in situ data were used to study eddies off the east coast of Florida. The surface thermal manifestation of the eddies identified in the infrared data were alternating cold and warm tongues, conforming to the cyclonic spin-off eddies observed by Lee (1975); however, the eddies identified in the satellite data were larger than those observed by Lee. Statistics derived from the satellite data indicated that the eddies had average major and minor axes of 136 and 36 km, respectively, assuming an elliptic shape. They moved northward at an average speed of 30 km/day, and the average period was 9 days. (Author)

**A80-19541 *** **Remote sensing for water quality and biological measurements in coastal waters.** R. W. Johnson and R. C. Harriss (NASA, Langley Research Center, Hampton, Va.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Jan. 1980, p. 77-85. 36 refs.

Recent remote sensing experiments in the United States' coastal waters indicate that certain biological and water quality parameters have distinctive spectral characteristics. Data outputs from remote sensors, to date, include: (1) high resolution measurements to determine concentrations and distributions of total suspended particulates, temperature, salinity, chlorophyll a, and phytoplankton color group associations from airborne and/or satellite platforms, and (2) low resolution measurements of total suspended solids, temperature, ocean color, and possibly chlorophyll from satellite platforms. A summary of platforms, sensors and parameters measured is given. Remote sensing, especially when combined with conventional oceanographic research methods, can be useful in such high priority research areas as estuarine and continental shelf sediment transport dynamics, transport and fate of marine pollutants, marine phytoplankton dynamics, and ocean fronts. V.L.

**A80-20095 #** **The study of the ocean from space (Issledovanie okeana iz kosmosa).** B. V. Novogrudskii, V. E. Skliarov, K. N. Fedorov, and K. S. Shifrin. Leningrad, Gidrometeoizdat, 1978. 55 p. 104 refs. In Russian.

The application of earth satellites and manned spacecraft to the study of the world's oceans is reviewed. Attention is given to the atmospheric transfer function in the visible, near-IR, middle-IR and microwave regions and the use of satellites in ocean data acquisition and transmission systems. The measurement of sea level and the topography of the ocean surface by means of orbital radar altimeters is discussed, together with IR and microwave measurements of ocean surface temperature and the study of surface roughness, surface evidence of internal waves, oil pollution and ice fields. Consideration is also given to the determination of ocean chlorophyll content and color distribution, coastal region characteristics, ocean salinity and other biological parameters from space. A.L.W.

**N80-10562*#** National Oceanic and Atmospheric Administration, Washington, D. C.
**INTERPRETING ASTP PHOTOGRAPHS OF THE OCEAN AND LOCATING THE AREA PHOTOGRAPHED, CASE STUDY OF THE GULF OF MEXICO**
G. A. Maul *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 371-383 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

Some of the Skylab recommendations relative to the problem of locating the ocean area obtained in the handheld-camera photographs and the problem of interpreting data in the space photographs by comparison with shipboard observations that were acquired at approximately the same time are discussed. Based on Skylab experience, the frequently observed circular cloud features were thought of as indicators of mesoscale turbulence in ocean currents. It was found that the features could be consistently explained as being attributable entirely to atmospheric changes and that the features were not associated with cold-core ocean eddies. M.M.M.

**N80-10563*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**VISUAL OBSERVATIONS OVER OCEANS**
R. D. Terry (Richard Terry and Assoc.) *In its* Apollo-Soyuz Test Project, Vol. 2 1979 p 385-407 refs

Avail: NTIS HC A99/MF A01 CSCL 08C

Important factors in locating, identifying, describing, and photographing ocean features from space are presented. On the basis of crew comments and other findings, the following recommendations can be made for Earth observations on Space Shuttle missions: (1) flyover exercises must include observations and photography of both temperate and tropical/subtropical waters; (2) sunglint must be included during some observations of ocean features; (3) imaging remote sensors should be used together with conventional photographic systems to document visual observations; (4) greater consideration must be given to scheduling earth observation targets likely to be obscured by clouds; and (5) an annotated photographic compilation of ocean features can be used as a training aid before the mission and as a reference book during space flight. M.M.M.

**N80-10564*#** Scripps Institution of Oceanography, La Jolla, Calif.
**ANTIPODAL SEAS**
Robert E. Stevenson *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 409-429 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

An oceanographic experiment was conducted to learn: (1) whether or not astronauts could be trained to observe specific ocean features from space; (2) the variability of certain sea surface conditions in time and space; and (3) the role that these ocean features play in our understanding of synoptic oceanography. Sea surface and subsurface data to be compared to astronaut observations were collected by ships and aircraft from waters east of Australia, north of New Zealand, east of Ireland, and east of Spain. The analysis show that observations by man from orbiting space platforms have an important role in the development of synoptic oceanography. K.L.

**N80-10565*#** Smithsonian Institution, Washington, D. C.
**MALTESE FRONT AND STRAIT OF SICILY OCEAN PATTERN ANALYSIS**
Daniel Jean Stanley *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 431-440 refs

Avail: NTIS HC A99/MF A01 CSCL 08B
Ocean surface phenomena related to turbulence, including possible internal waves, are observed in Apollo Soyuz Test Project color photographs of the eastern part of the Strait of Sicily between Djerba and the southeastern corner of Sicily. The convergence of the eastward flowing, less saline upper water of Atlantic origin and the dense intermediate water flowing undernearth it in the opposite direction gives rise to the Maltese Front clearly visible off Cape Passero, Sicily. The investigation shows that the geographic position of these ocean surface features is in part related to sea floor topogaphy. The vertical coverage made from an altitude of 226 km allows good definition of turbulence phenomena and serves to supplement earlier physical oceanographic observations made of the central region of the Mediterranean Sea. K.L.

**N80-10566*#** Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
**OCEAN COLOR OBSERVATIONS**
C. S. Yentsch, W. Skea, J. C. Laird, and T. S. Hopkins *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 441-454 refs

(Contracts NAS5-22948; E(11-1)-2538)
Avail: NTIS HC A99/MF A01 CSCL 08J
Apollo astronauts were briefed on four features that could alter ocean color: (1) phytoplankton chlorophyll; (2) dissolved yellow substance; (3) suspended sediments; and (4) bottom reflection. Before and during the Apollo-Soyuz mission, the crew was alerted to the possibility of a red tide occurrence along the coast of new England. They were unable to obtain useful photographs because of heavy fog and cloud cover. The astronauts were successful in observing ocean discolorations, and their verbal comments indicate that they were aware of the causes and sources of these color changes. Experience on this mission suggests that ground crews can work with astronauts in attempts to locate discolorations and to determine their extent and their sources. K.L.

**N80-10568*#** McGill Univ., Montreal (Quebec).
**ASTP AT BARBADOS: MESOSCALE POOLS OF AMAZON RIVER WATER IN THE WESTERN TROPICAL ATLANTIC**
G. Borstad *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 481-497 refs

Avail: NTIS HC A99/MF A01 CSCL 08H
Sea surface data was obtained at Barbados for temperature, salinity, chlorophyll concentration, clarity, color, and plankton concentration. The data suggest a succesive passage of pools of brackish Amazon River water until late August. Hence, it is unlikely that the discolored water observed by the Apollo crew during the Apollo Soyuz Test Project was due to the Orinco River. The expansive freshening of the Western Tropical Atlantic by brown colored Amazon water in July would mask any effect by the smaller Orinco. K.L.

**N80-10569*#** Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
**ESTIMATE OF TOTAL REFLECTANCE FROM THE ORINOCO RIVER OUTFLOW**
C. S. Yentsch and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 499-503 refs

(Contracts NAS5-22948; E(11-1)-2538)
Avail: NTIS HC A99/MF A01 CSCL 08H
The Orinoco River Delta was photographed by Apollo astronauts. The photographs show discrete water color zones that reflect the mixing of the sediment laden Orinoco outflow with the water of the tropical Atlantic. A datacolor/edge enhancer analysis, assuming a 5-percent reflectance value for the open ocean water, showed the reflectance of the area varied between 4 percent for the jungle and approximately 13 percent for sediment laden river outflow. These values approximate those obtained by direct measurements of the Mississippi River Delta water. The results confirm that the reflectance from coastal waters is not high enought to saturate instruments onboard unmanned satellites such as the Coastal Zone Scanner. K.L.

**N80-10570*#** National Oceanic and Atmospheric Administration, Seattle, Wash.
**OBSERVATIONS OF INTERNAL-WAVE SURFACE SIGNATURES IN ASTP PHOTOGRAPHS**
John R. Apel *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 505-509 refs

Avail: NTIS HC A99/MF A01 CSCL 08C
Three Apollo Soyuz Test Project photographs are presented which show indications of oceanic internal gravity waves. The features are indicated by periodic changes in the optical reflectivity of the ocean surface overlying the waves. Position and conditions of the internal wave photographs are presented and theories of the structure and existence of the surface signatures are reviewed. A.W.H.

**N80-10573*#** Environmental Defense Fund, Inc., Denver, Colo.
**USE OF APOLLO-SOYUZ PHOTOGRAPHS IN COASTAL STUDIES**
M. T. El-Ashry *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 531-543 refs

Avail: NTIS HC A99/MF A01 CSCL 08J
The use of spaceborne photography in coastal studies is examined. Apollo Soyuz photographs of coastal zones are provided to demonstrate various areas of application in coastal studies. These include shoreline features such as barrier islands, beach ridges, salt marshes, tidal inlets, and tidal deltas; shoreline changes including identification of major areas of erosion or accretion and prediction of future changes along rapidly/changing shorelines; and information regarding littoral drift. A.W.H.

**N80-10583#** Coast Guard Research and Development Center, Groton, Conn.
**LONG-TERM TRACKING OF ARCTIC ICEBERGS Final Report**
R. Q. Robe and D. C. Maier Apr 1979 41 p refs
(AD-A072473; CGR/DC-8/79; USCG-D-36-79) Avail: NTIS HC A03/MF A01 CSCL 08/12
Seven Greenland icebergs were tracked, two in 1977 and five in 1978, using ADRAMS (Air-Deployable Random Access Measurement System) ice buoys. The ice buoys transmit a signal to the NIMBUS-6 satellite which is used in computing the buoy's position. Observation periods ranged from 138 days to 202 days. The tracking of two icebergs began near Disko Island, Greenland, and the tracking of the other five began on the Baffin Island side of Baffin Bay near Davis Straits. The icebergs initially located near Disko Island did not appear to be influenced by any well-defined current system, the drift track of each was erratic and the drift speeds generally less than 0.20 m/s. The icebergs initially located along the coast of Baffin Island followed the prevailing currents southward. These icebergs drifted at speeds as high as 0.8 m/s with model speeds generally falling between 0.10 m/s and 0.20 m/s. Groundings occurred frequently occupying 40 percent of the observed time. Data processing

methods, accuracy of the ice buoy system, and a detailed analysis of each iceberg's drift is presented. It was estimated using the drift data obtained, that approximately 190 days are needed for an average size iceberg to travel the 1100 nautical miles from Cape Dyer, Baffin Island, to the outer limits of the Grand Banks of Newfoundland. GRA

**N80-11532*#** Battelle Columbus Labs., Ohio.
**SEASAT DEMONSTRATION EXPERIMENTS WITH THE OFFSHORE OIL, GAS AND MINING INDUSTRIES Final Report**
A. G. Mourad, A. C. Robinson, and J. E. Balon Nov. 1979 145 p refs
(Contract NASw-2800)
(NASA-CR-162423; BCL-OA-TFR-79-6) Avail: NTIS HC A07/MF A01 CSCL 05B

Despite its failure, SEASAT-1 acquired a reasonable volume of data that can be used by industrial participants on a non-real-time basis to prove the concept of microwave sensing of the world's oceans from a satellite platform. The amended version of 8 experimental plans are presented, along with a description of the satellite, its instruments, and the data available. Case studies are summarized for the following experiments: (1) Beaufort Sea oil, gas, and Arctic operations; (2) Labrador Sea oil, gas, and sea ice; (3) Gulf of Mexico pipelines; (4) U.S. East Coast offshore oil and gas; (5) worldwide offshore drilling and production operations; (6) Equatonal East Pacific Ocean mining; (7) Bering Sea ice project; and (8) North Sea oil and gas.A.R.H.

**N80-12479** Deutsches Hydrographisches Institut, Hamburg (West Germany).
**RESEARCH INTO DETERMINING CHEMICAL PARAMETERS AT THE SURFACE OF THE SEA BY REMOTE SENSING [UNTERSUCHUNG ZUR BESTIMMUNG CHEMISCHER PARAMETER VON DER MEERESOBERFLAECHE DURCH FERNERKUNDUNG]**
D. Schmidt and K. Struebing *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 131-138 refs In GERMAN

Avail: Issuing Activity

In the example selected, regularly introduced quantities of waste solution released by a titanium dioxide fabricant situated in northwest Helgoland since 1969 are studied. Remarkable coloration phenomena are observed; these phenomena have been investigated over a period of several years. Measurements made in the sea and results from aerial and satellite photography are discussed together with image analysis techniques. Images of ships' wakes and their digital treatment are presented. Author (ESA)

**N80-12516** Deutsches Hydrographisches Institut, Hamburg (West Germany).
**DETERMINATION OF THE OPTICAL PROPERTIES OF THE SEA IN THE GERMAN BIGHT [MEERESOPTISCHE UNTERSUCHUNGEN IN DER DEUTSCHEN BUCHT]**
H. Gienapp *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 471-492 refs In GERMAN

Avail: Issuing Activity

The spectral distribution, transmission scattering, and CIE coordinate characteristics of the sea were investigated in the framework of the 1976 FMP program. The region between Helgoland and Sylt, and the Elb estuary were studied. The sea on the southern boundary of the Verklappung's region was shown to be very dirty. Relations between color metric magnitudes Gelbstoff, Chlorophyll, and suspended matter contents were shown to exist. Comparisons were made with ERTS satellite photographs. A high degree of correlation in some of these relations was seen for the Elb estuary. The DIBIAS system is used in the calculations performed. Author (ESA)

**N80-12535*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OCEAN CHLOROPHYLL STUDIES FROM A U-2 AIRCRAFT PLATFORM**
Hongsuk H. Kim, Charles R. McClain, Lamdin R. Blaine, William D. Hart (Sci. Systems and Applications, Inc., Lanham, Md.), Larry P. Atkinson (Skidaway Inst. of Oceanography, Savannah, Ga.), and James A. Yoder (Skidaway Inst. of Oceanography, Savannah, Ga.) Aug. 1979 37 p refs
(NASA-TM-80574) Avail: NTIS HC A03/MF A01 CSCL 08J

Chlorophyll gradient maps of large ocean areas were generated from U-2 ocean color scanner data obtained over test sites in the Pacific and Atlantic Oceans. The delineation of oceanic features using the upward radiant intensity relies on an analysis method which presupposes that radiation backscattered from the atmosphere and ocean surface can be properly modeled using a measurement made at 778 nm. An estimation of the chlorophyll concentration was performed by properly ratioing radiances measured at 472 nm and 548 nm after removing the atmospheric effects. The correlation between the remotely sensed data and in-situ surface chlorophyll measurements was validated in two sets of data. The results show that the correlation between the in-situ measured chlorophyll and the derived quantity is a negative exponential function and the correlation coefficient was calculated to be -0.965. R.E.S.

**N80-12546#** National Oceanic and Atmospheric Administration, Washington, D. C.
**SEASAT: GULF OF ALASKA EXPERIMENT. SURFACE TRUTH DATA INVENTORY**
John C. Wilkerson and S. Lynn McNutt 15 Feb. 1979 100 p
(PB-294616; NOAA-79031609) Avail: NTIS HC A05/MF A01 CSCL 05B

An experiment designed to collect in situ physical oceanographic and meteorological data for verification and evaluation of SEASAT sensor performance is described. The experiment was carried out from ships, aircraft, and buoys. An inventory of all physical oceanographic and meteorological surface truth data collected during the experiment from each of the participating platforms is presented. J.M.S.

**N80-13753*#** EG and G Washington Analytical Services Center, Riverdale, Md
**A STUDY OF POSSIBLE SEA STATE INFORMATION IN THE SAMPLE AND HOLD GATE STATISTICS FOR THE GEOS-3 SATELLITE ALTIMETER Final Report**
W. T. Wells, K. L. Borman, R. D. Mitchell (RCA/Missile and Surface Radar Div., Moorestown, N.J.), and D. J. Dempsey (RCA/Missile and Surface Radar Div., Moorestown, N.J.) Sep. 1979 36 p refs
(Contract NAS6-2497)
(NASA-CR-156858) Avail: NTIS HC A03/MF A01 CSCL 08C

The statistical variations in the sample gate outputs of the GEOS-3 satellite altimeter were studied for possible sea state information. After examination of a large number of statistical characteristics of the altimeter waveforms, it was found that the best sea predictor for H-1/3 in the range of 0 to 3 meters was the 75th percentile of sample and hold gate number 11.
R.E.S.

**N80-14390#** Naval Ocean Research and Development Activity, Bay St. Louis, Mo. Mapping, Charting and Geodesy Development Group.
**OPERATING SCENARIO FOR A HYDROGRAPHIC AIRBORNE LASER SCUNDER (HALS) Interim Report**
H. J. Byrnes May 1979 36 p refs
(AD-A073872; NORDA-TN-34) Avail: NTIS HC A03/MF A01 CSCL 08/10

This note is intended to acquaint interested parties with the anticipated deployment of Hydrographic Airborne Laser Sounder (HALS). Data acquisition, data processing, data reduction rationale, data density, test results, and environmental considerations are covered. The document is intended primarily as presolicitation information for the HALS procurement. GRA

**N80-14663#** Naval Postgraduate School, Monterey, Calif.
**A STUDY OF THE RELATIONSHIP BETWEEN OCEANIC CHEMICAL MESOSCALE AND SEA SURFACE THERMAL STRUCTURE AS DETECTED BY SATELLITE INFRARED IMAGERY M.S. Thesis**
Don Alan Nestor Jun. 1979 93 p refs
(AD-A074186) Avail: NTIS HC A05/MF A01 CSCL 08/10

In recent years the study of ocean fronts and eddies has become increasingly important to the U.S. Navy for they are of vital importance in understanding underwater sound transmission. From the history of satellite pictures for the area of the ocean off the central California coast, it appears that cold water which has come to the surface as a result of upwelling has become intertwined within the California current. The persistent thermal features in the sea surface which are formed were the subject area of this study. Direct telephone contact was established with the satellite receiving station which afforded real time satellite information as to the thermal structure of the sea surface on a mesoscale. This satellite sensed thermal structure was then compared with in situ nutrient and temperature data collected on three cruises on board the research vessel ACANIA. The agreement between the in situ data and the satellite imagery was very strong and the utilization of satellite imagery was shown to be a very effective method to localize an ocean front. GRA

**N80-14664#** Polar Research Lab., Inc., Santa Barbara, Calif.
**ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS (AREA). TECHNICAL REPORT NO. 8: ARCTIC LEAD-AIRDROP DATA BUOY**
Beaumont M. Buck, Samuel P. Burke, and John O. Anderson 25 Jul. 1979 22 p refs
(Contract N00014-79-C-0042)
(AD-A074731; PRL-TR-8) Avail: NTIS HC A02/MF A01 CSCL 20/1

Arctic data buoys are capable of data collection that is impractical of accomplishment by manned-station techniques primarily because of high logistics costs. These cost differentials can be even further reduced by buoy paradrop. Size, weight, and power limit the usefulness of such devices, but their most serious drawback has been automatic deployment of sensors under the ice. A new concept which employs a data buoy that is designed for airdrop into open water leads of opportunity, is powered for up to a year's life, and uses the new TIROS-N ARGOS system for position and data recovery which offers promise in solving these problems. The configuration of the buoy, called 'LAD' (Lead Air Droppable), is described along with the results of preliminary Arctic field tests of the concept. Because of the limited nature of those tests, viability of the approach is not yet established, and additional trials are planned for spring 1980. GRA

**N80-14665#** Naval Research Lab., Washington, D. C. Space Science Div.
**OCEAN WAVE SPECTROMETER MEASUREMENTS IN THE GULF STREAM EXPERIMENT Final Report**
Davidson T. Chen, Donald L. Hammond, and Paul Bey 20 Aug. 1979 54 p refs
(WF52553000; RR0310343)
(AD-A074369; AD-E000321; NRL-MR-4070) Avail: NTIS HC A04/MF A01 CSCL 08/3

By assuming finite conducting, Gaussian-distributed, statistically stationary and homogeneous ocean surface, the ocean wave spectrometer measurements made in the Gulf Stream Experiment have demonstrated the capability of inferring the directional wave number slope spectra by using the specular point model for look-angles of less than 20 degrees. These measurements have also demonstrated the necessity of independent measurements of wind direction, mean square surface slope, and foam and spray. The results also indicate that at least four independent directional measurements with spatial resolution of 0.1 meters or smaller and spatial coverage of 750 to 1000 meters are necessary. GRA

**N80-15543#** National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
**SURVEY OF SATELLITE SENSORS AND DATA WITH APPLICATION TO OTEC RESOURCE AND OPERATIONS REQUIREMENTS**
George A. Maul, Fred M. Vukovich, Mark Bushnell, and Bobby W. Crissman Mar. 1979 80 p refs
(PB-300297/9; NOAA-TM-ERL-AOML-37; NOAA-79081002) Avail: NTIS HC A05/MF A01 CSCL 22A

The existing instruments and the capability of those instruments for observing geophysical variables that contribute to surface thermal resource fluctuations, the operating environment, and the impact of an ocean thermal energy conversion plant on the ocean are summarized. It is emphasized that remote sensing is not capable at this stage in its development to independently provide all the observations necessary for measurement of a given variable. Only an integrated in situ and remotely sensed measurement system can offer high quality data needed for environmental research. GRA

**N80-15603#** Research Triangle Inst., Research Triangle Park, N. C.
**SEA-SURFACE TEMPERATURE VARIABILITY ANALYSIS OF POTENTIAL OTEC SITES UTILIZING SATELLITE DATA Final Report**
F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King Aug. 1978 159 p refs
(Contract EG-77-C-05-5444)
(ORO-5444-1) Avail: NTIS HC A08/MF A01

An analysis of the constancy of the sea-surface temperature in candidate locations for ocean thermal energy conversion (OTEC) siting was performed. Satellite infrared data were used to identify and locate major thermal fronts at the sea surface. These data were then used to glean certain statistics on these fronts. In situ data were used, when available, to determine temperature difference across specified thermal fronts. The study was performed in three regional locations of interest to OTEC. The specific regions are: Region I, Eastern Gulf of Mexico (bounded by 22 N to 30 N and 91 W to the west coast of Florida including the Straits of Florida), Region II, the east coast of Florida (bounded by 23 N to 32 N and the east coast of Florida to 79 W), and Region III, Puerto Rico and vicinity, (bounded by 17 to 19 N, 64 to 68 W). Results are presented and discussed. DOE

**N80-15772#** Environmental Data and Information Service, Washington, D. C.
**INTERNATIONAL DECADE OF OCEAN EXPLORATION, VOLUME 7 Progress Report, Apr. 1977 - Apr. 1978**
Oct. 1978 108 p refs
(NOAA-S/T-78-211-Vol-7) Avail: NTIS MF A01; SOD HC

A number of programs concerned with the use of the ocean and it's resources are presented. Specific programs dealing with environmental quality, improving environmental forecasting, expanding sea bed assessment activities, and developing an ocean monitoring system are described. Information, data inventories, and lists of scientific reports derived from U.S. IDOE projects are presented. A.W.H.

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## 06

## HYDROLOGY AND WATER MANAGEMENT

**Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.**

**A80-10125** # **Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation (Osnovy distantsionnykh metodov izmereniia vlagozapasov v snege i vlazhnosti pochv po gamma-izlucheniiu zemli).** A. V. Dmitriev and Sh. D. Fridman. Leningrad, Gidrometeoizdat, 1979. 304 p. 99 refs. In Russian.

The book deals with experience and practical use of aerial measurements of snow water equivalent from passive terrestrial gamma radiation. The potentialities of such methods in the solution of various hydrological and agricultural meteorological problems is discussed and the principles of snow gauging by airborne radiological surveys are examined. A gamma radiation system for aerial snow surveying is examined and the error of the system is assessed. V.P.

**A80-10370** **Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson (Etude par télédétection de la dispersion en mer des eaux estuariennes issues de la Gironde et du Pertuis de Maumusson).** P. Castaing (Bordeaux I, Université, Talence, Gironde, France), G. P. Allen, Y. Moign (Bretagne, Center Océanologique, Brest, France), and M. Houdart (Centre National pour l'Exploitation des Océans, Paris, France). *Oceanologica Acta,* vol. 2, Oct. 1979, p. 459-468. 18 refs. In French.

The present study was carried out in order to determine the nature of seaward dispersion of estuary waters and suspended sediments during spring tide and high river flow in the Gironde inlet area. On June 3, 1977, three flights were made over the inlet at mid-ebb, low tide, and mid-flood. Thermal IR coverage was obtained along with black and white photographs. These data were correlated with accompanying measurements of current velocity, salinity, temperature, and suspended sediment concentration. B.J.

**A80-15054** **Use of satellite infrared data for geomorphology studies.** S. R. Schneider, D. F. McGinnis, Jr., and J. A. Pritchard (NOAA, National Environmental Satellite Service, Washington, D.C.). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 313-330. 28 refs.

Enhanced nighttime thermal infrared imagery and digital data from a NOAA polar orbiting satellite were used to map drainage patterns and landforms in North and South Dakota. Features delineated include the Missouri Escarpment from Saskatchewan to the Nebraska border, the Manitoba Escarpment, Coteau des Prairies, recessional moraines on the Coteau du Missouri and partial drainage boundaries for the following rivers: James, Big Sioux, Minnesota, Red of the North, Souris, and the main stem of the Missouri plus its western tributaries in the Dakotas. In several instances drainage from gentle slopes in the Midwest was discerned and correlated with local relief. Analyses of satellite digital thermal data for western tributaries of the Missouri River revealed north-facing slopes to be warmer than south-facing slopes by an average of 1.5 C. Comparisons of ground and satellite temperatures for 11 stations in South Dakota showed good agreement. (Author)

**A80-15055** **A study of moisture conditions in the Pantanal of Brazil using satellite imagery.** J. P. Darch (Bedford College, London, England). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 331-348. 9 refs.

The combined use of additive viewing and digital processing of Landsat-2 imagery of part of the Pantanal of Brazil has allowed detailed maps of the drainage network to be constructed. The distributions have been made of wet and dry areas, including differentiations of clear water, water containing suspended sediments, and categories of land with differing moisture conditions. Some unconventional use of color filters and MSS band combinations are suggested in order to extract maximum information from the imagery. Density slicing has allowed gray-scale values to be placed on the three categories of land identified. The distributions of the identified categories are verified by comparing the information from the visual classification with the classes isolated by density slicing. (Author)

**A80-15066** **Monitoring of euphotic depth from aircraft.** B. M. Sorensen and G. Maracci (Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). *Remote Sensing of Environment,* vol. 8, Dec. 1979, p. 349-351.

The determination by aircraft of the euphotic depths of three lakes in distinct trophic states is presented. Numbers of white panels, analogous to Secchi disks, submerged in Lakes Monate, Comabbio and Varese in northern Italy to various depths that were visible from an altitude of 1000 feet were counted, and the depths at which the panels were visible were compared with on-site conventional Secchi disk depth determinations in order to obtain a relation between panel visibility and euphotic depth. The reliability and reproducibility of the method are discussed, and it is noted that the depths obtained are considered to be predominantly functions of plankton content in the oligotrophic, eutrophic and polluted lakes. A.L.W.

**A80-15265** # **Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management.** E. L. Morgan (Tennessee Technological University, Cookeville, Tenn.), K. W. Eagleson (North Carolina, Dept. of Natural Resources, Raleigh, N.C.), R. Herrmann (U. S. Department of the Interior, National Park Service, Atlanta, Ga.), and N. D. McCollough, Jr. (Tennessee, University, Knoxville, Tenn.). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, 9th, San Francisco, Calif., July 16-19, 1979, Paper 79-ENAs-41.* 6 p. 6 refs. Members, $1.50; nonmembers, $3.00. Research supported by the Tennessee Technological University and U.S. Department of the Interior.

**A80-20261** **The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota.** J. Schlesinger, B. Ripple, and T. Loveland (South Dakota State Planning Bureau, Pierre, S. Dak.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 440-456. 7 refs.

**A80-20264** **Satellite snow-cover observations in Arizona.** H. H. Schumann (U.S. Geological Survey, Phoenix, Ariz.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 480-489. 7 refs.

Techniques for snow-cover mapping from imagery acquired by satellites are discussed. Multispectral scanners aboard the satellites of the Landsat series provide high-resolution imagery (80 m ground resolution) which can be interpreted visually, directly or using different image-enhancement techniques, and which is also available in digital form for computerized mapping systems. The imagery covers 185- by 186 km areas and is almost orthographic when used for direct mapping at the common scale of 1:1,000,000. The main limitation is that only one observation is available every 9 days. Meteorological satellites provide small-scale imagery in the visible and infrared parts of the spectrum on a daily basis and have horizon-to-horizon coverage. This imagery is used for operational snow-cover mapping in large watersheds. The main disadvantages are low resolution and geometric distortion, though recent research indicates that geometric correction, image enhancement and snow-cover measurements could be accomplished by computer processing of the satellites' digital data. V.L.

**A80-16564** # **Principals of mapping hydrological parameters from natural systems, using satellite photography (Printsipy kartirovaniia gidrologicheskikh parametrov po prirodnym kompleksam s ispol'zovaniem kosmicheskikh snimkov).** A. V. Lebedev. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 89-108. 31 refs. In Russian.

**A80-20194** * **A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data.** L. J. Allison, T. J. Schmugge (NASA, Goddard Space Flight Center, Greenbelt, Md.), and G. Byrne (Commonwealth Scientific and Industrial Research Organization, Canberra, Australia). *American Meteorological Society, Bulletin,* vol. 60, Dec. 1979, p. 1414-1427. 40 refs.

The chronological development and diminution of six floods in eastern Australia during January, February, and March 1974 were mapped for the first time by the Nimbus Electrically Scanning Microwave Radiometer (ESMR). Day and nighttime ESMR (19.35 GHz) coverage was analyzed for the low gradient, flooded Darling River system in New South Wales. Apparent movement of surface water as indicated by low brightness temperatures (less than 250 K, day and less than 240 K, night) was easily followed around the curved runoff basin along the northern shoreline of the flooded Darling River during this 3-month period. This pattern was in good agreement with flood crest data at selected river height gage stations, even under cloudy conditions. (Author)

**A80-20240** * **Monitoring of deltaic wetland processes with seasonal aerial photography.** A. R. Benton, Jr. and W. W. Snell (Texas A&M University, College Station, Tex.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 37-57. 10 refs. Research supported by the Texas Water Development Board and Texas A&M University; Grant No. NGL-44-001-001.

A year-long study of four river deltas, using color infrared photography at three-month intervals, showed clearly the impact of damming the lower river or channelizing its outlet on the wetland environment. An important result of the season's photography was the dramatic appearance of the detrital material being flushed out of the deltaic wetlands by flood waters, and moved down into the lower estuaries for use by the marine organisms in the lower tropical levels. The species makeup and relative vigor of the deltaic plant communities were well recognizable on the imagery, as was the flushing mechanism in one stillviable delta marsh. V.P.

**A80-20243** **Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data.** A. Cibuzar (A.W. Research Laboratories, Brainerd, Minn.), R. Kluegel, and L. Hansmeyer (Regional Development Commission, Staples, Minn.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 105-115. 11 refs.

Landsat digital data from the July 24, 1976 overflight was used in conjunction with existing water quality information to produce color coded maps of Secchi Disc depths and chlorophyll a concentrations within the lakes of north central Minnesota. Regression analysis of the radiance values and the water quality data indicated a relationship between Secchi depth and the ratio of Landsat band 4 to 5, and a relationship between chlorophyll a to band 6. The Landsat water quality data has provided local land use/water managers with a useful data base so they may better implement the policies fashioned by the decision makers. (Author)

**A80-20245** **Remote sensing of Playa lakes as a source of climatic data.** J. I. Ebert (National Park Service and University of New Mexico, Remote Sensing Div., Albuquerque, N. Mex.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 159-175. 31 refs. NSF Grant No. SOC-75-02253.

A possible solution to the present fragmentary climatic record is the measurement of closed-basin or Playa lakes - water bodies with no physical outward flow nor evaporative outflow. Remote sensing offers methods by which such measurements can be made over large parts of the earth, possibly using automated techniques. In the present paper, the theoretical and practical bases of Playa lake measures are discussed. It is suggested that the nature of these measures, resulting from a combination of meteorological variables and such things as soil properties and landform, may constitute an ideal source of information on actual available water - providing data far more useful than those resulting from meteorological instruments. V.P.

**A80-20247** * **Passive microwave studies of frozen lakes.** D. K. Hall, J. L. Foster, A. Rango, and A. T. C. Chang (NASA, Goddard Space Flight Center, Hydrospheric Sciences Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 195-208. 8 refs.

Lakes of various sizes, depths and ice thicknesses in Alaska, Utah and Colorado were overflown with passive microwave sensors providing observations at several wavelengths. A layer model is used to calculate the microwave brightness temperature, T sub B (a function of the emissivity and physical temperatures of the object), of snowcovered ice underlain with water. Calculated T sub B's are comparable to measured T sub B's. At short wavelengths, e.g., 0.8 cm, T sub B data provide information on the near surface properties of ice covered lakes where the long wavelength, 21.0 cm, observations sense the entire thickness of ice including underlying water. Additionally, T sub B is found to increase with ice thickness. 1.55 cm observations on Chandalar Lake in Alaska show a T sub B increase of 38 K with an approximate 124 cm increase in ice thickness. (Author)

**N80-10567*#** Smithsonian Institution, Washington, D. C.
**ANALYSIS OF WATER COLOR AS SEEN IN ORBITAL AND AERIAL PHOTOGRAPHS OF CAPE COD, NANTUCKET, AND MARTHA'S VINEYARD, MASSACHUSETTS**
Tracey Tisdall and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 455-480 refs
Avail: NTIS HC A99/MF A01 CSCL 08J

Coastal water color was analyzed in two Apollo-Soyuz photographs. The natural color of the photographs enabled recognition of shoals and suspended sediments, sediment transport by longshore drift, wind streaks, and crests and troughs of internal ocean waves. Comparison with high altitude aircraft photographs revealed that the aerial photographs are necessary for detailed analyses and the spaceborne photographs are useful for studying large areas. A comparison of the aerial photographs with bathymetric charts showed that numerous changes occurred in the coastlines after the charts were made. Absolute reflectance values of shoals, chlorophyll concentrations, sediments, etc. were roughly estimated, but could not be accurately determined. K.L.

**N80-10572*#** Smithsonian Institution, Washington, D. C.
**SUSPENDED-SEDIMENT DISPERSAL PATTERNS OF RIVER DELTAS PHOTOGRAPHED BY ASTP**
Ted A. Maxwell *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 521-530 refs

Avail: NTIS HC A99/MF A01 CSCL 08H

Orbital photographs of five river deltas are presented. Suspended sediment plume patterns are identified and are related to models of sedimentation in a deltaic environment. The relative effects of river inertia, buoyancy of suspended matter, and turbulent bed friction are evaluated using delta geometry and plume pattern. A.W.H.

**N80-10574*#** Texas Univ. at Austin.
**SOUTH AMERICAN RIVER MORPHOLOGY AND HYDROLOGY**
R. K. Holz, V. R. Baker, S. M. Sutton, Jr., and M. M. Penteado-Orellana (Fundacao Univ. de Brasilia) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 545-594 refs
Avail: NTIS HC A99/MF A01

A guide to the hydrologic properties of streams in the Amazon and Paraguay Basins is presented. Photographs are presented from the Apollo Soyuz Test Project of the Amazon Basin. Stream regimes, including analyses of meander wavelengths, flood plain development, and basin morphology are discussed. Basin size, drainage network density, flood plain width, vegetation types and density, climatic factors, and terrain variability are assessed. Adjustments of changes in river morphology caused by altered water and sediment discharges and by quaternary climatic changes are discussed. A.W.H.

**N80-10575*#** Environmental Research and Technology, Inc., Concord, Mass.
**SNOW HYDROLOGY STUDIES**
M. D. Smallwood, C. J. Bowley, and J. C. Barnes *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 595-615 refs
Avail: NTIS HC A99/MF A01 CSCL 08L

Photographs from the Apollo Soyuz Test Project of snow covered areas in the northwestern United States and Canada, the Chilean Andes, and the southern Alps of New Zealand are discussed. The photographs are analyzed and a tendency for the snowline elevations to be lower in the areas surrounding the permanent snowfields and glaciers rather than in areas of seasonal snowpack is examined. A.W.H.

**N80-10590#** University of Eastern Michigan, Ypsilanti. Dept. of Geography and Geology.
**IMPACT OF GREAT LAKES WATER LEVEL FLUCTUATIONS ON COASTAL WETLANDS Final Report, 1 Oct. 1976 - 30 Nov. 1978**
Eugene Jaworski, C. Nicholas Rapnael, P. J. Mansfield, and Brooks B. Williamson Apr. 1979 364 p refs
(Contract DI-14-0001-7163)
(PB-296403/9; W79-07001; OWRT-B-045-MICH(1)) Avail: NTIS HC A16/MF A01 CSCL 08H

Field measurements were collected at seven study areas along Lakes Michigan, Huron, St. Clair, and Erie. Surface landforms were mapped and models of the four coastal wetland types were developed. With the aid of aerial photography and field bisects, the zonal plant communities were identified and three historical distribution maps were constructed which represented various lake level conditions. Field data indicate that water level, wave energy, and substrate type are important factors in determining the shifting of plant communities in response to lake level fluctuations. GRA

**N80-11538#** Army Cold Regions Research and Engineering Lab., Hanover, N. H.
**DETECTION OF ARCTIC WATER SUPPLIES WITH GEOPHYSICAL TECHNIQUES**
S. A. Arcone, A. J. Delaney, and P. V. Sellmann Jun. 1979 37 p refs
(DA Proj. 4A7-62730-AT-42)
(AD-A072157; CRREL-79-15) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report discusses the application of several modern geophysical techniques to groundwater exploration in areas in permafrost. These methods utilize the principles of magnetic induction and radiowave surface impedance in the 10- to 400-kHz band, the techniques of impulse and side-looking radar in the 50- to 10,000-MHz band, and also some optical techniques using imagery obtained from a satellite. Low frequency case studies demonstrate the use of the techniques for detecting free water under an ice cover in shallow, almost completely frozen lake basins, and thaw zones within lake beds, stream channels, and in permafrost in general. The radar studies demonstrate the use of these techniques for determining depth of free water and ice cover thickness on lakes and rivers. GRA

**N80-11553#** National Technical Information Service, Springfield, Va.
**REMOTE SENSING APPLIED TO HYDROLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979**
Audrey S. Hunderman Aug. 1979 219 p Supersedes NTIS/PS-78/0792 and NTIS/PS-77/0677
(NTIS/PS-79/0845/2; NTIS/PS-78/0792; NTIS/PS-77/0677)
Avail: NTIS HC $28.00/MF $28.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineration, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 210 abstracts, 22 of which are new entries to the previous edition. GRA

**N80-12478** Hamburg Univ. (West Germany).
**ON THE PROBLEM OF THE REMOTE SENSING OF SUBSTANCES IN WATER BY MULTISPECTRAL SCANNING [ZUM PROBLEM DER FERNERKUNDUNG VON SUBSTANZEN IM WASSER MIT DEM MULTISPEKTRALSCANNER]**
R. Doerffer *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 123-130 refs In GERMAN

Avail: Issuing Activity

Measurements devised to determine the characteristics and concentrations of three groups of substances (those producing a yellow/brown coloration, suspended matter and phytoplankton) are described. If qualitative and quantitative information is to be deduced, account must be taken of contributions to the measured signal arising from ground surfaces, interfaces and the atmosphere. Backscattered radiation fields are related to concentration levels. Author (ESA)

**N80-12493** Freiburg Univ. (West Germany).
**INTERPRETATION OF WATER QUALITY USING REMOTE SENSING TECHNIQUES [ZUR INTERPRETATION DER QUALITAET VON WASSERKOERPEN AUS FERNERKUNDUNGSAUFZEICHNUNGEN]**
H. Dietze, G. Hildebrandt, and D. Mahr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 257-270 In GERMAN

Avail: Issuing Activity

Characteristics of large water surfaces and waterways were investigated using an eleven channel multiscanner and from aerial photographs taken at different heights and times of the year. The results obtained show how information in the near infrared is influenced by high absorption. A more realistic interpretation of the results obtained can be achieved by employing a VP 8 analog evaluation system. A table of measured characteristics for eutrophic and non-eutrophic water masses is presented. Author (ESA)

**N80-12518*#** South Dakota State Univ., Brookings. Remote Sensing Inst.
**HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jul. - Sep. 1979**
Donald G. Moore, Principal Investigator and J. L. Heilman Sep. 1979 3 p ERTS
(Contract NAS5-24206)
(E80-10002; NASA-CR-162379; SDSU-RSI-79-15) Avail: NTIS HC A02/MF A01 CSCL 08H

**N80-12520*#** National Oceanic and Atmospheric Administration, Washington, D. C.
**APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report**
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 2 Oct. 1979 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10004; NASA-CR-162381) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Additional analyses of Luverne, Minnesota ground data revealed that soil moisture variations are independent of elevation effects. Tidal fluctuations in the Potomac River and Delaware Bay were examined as a function of surface temperature. Preliminary findings suggest that temperature boundaries are sufficient to detect various stages of the tidal cycle in Delaware Bay, but are as yet uncertain for prediction in the Potomac River. At least three additional cases are needed to completely evaluate the tidal cycle. An alphanumeric printout at a scale of 1:1,000,000 compares closely with a 1:1,000,000 scale DMD image of the Chesapeake Bay region.

**N80-12522*#** Commission of the European Communities, Ispra (Italy).
**MAPPING THERMAL INERTIA, SOIL MOISTURE AND EVAPORATION FROM AIRCRAFT DAY AND NIGHT THERMAL DATA**
J. Dejace, Principal Investigator, J. Meger, M. Kohl, G. Maracci, P Reiniger, G. Tassone, and J. Huygen 1978 10 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Proj. TELLUS)
(E80-10006; NASA-CR-162383) Avail: NTIS HC A02/MF A01 CSCL 08G

**N80-12527*#** Pennsylvania State Univ., University Park. Dept. of Meteorology.
**REMOTE ESTIMATION OF SURFACE MOISTURE OVER A WATERSHED M.S. Thesis**
Paul Jeffrey Kocin, Principal Investigator Nov. 1979 70 p refs Sponsored by NASA ERTS
(E80-10025; NASA-CR-162368) Avail: NTIS HC A04/MF A01 CSCL 08H

The author has identified the following significant results. Contoured analyses of moisture availability, moisture flux, sensible heat flux, thermal inertia, and day and nighttime temperatures over a Missouri watershed for a date in June and in September show that forests and creeks exhibit the highest values of moisture availability, whereas farmlands and villages are relatively dry. The distribution of moisture availability over agricultural districts differs significantly between the two cases. This difference is attributed to a change in the surface's vegetative canopy between June and September, with higher moisture availabilities found in the latter case. Horizontal variations of moisture, however, do indicate some relationship between moisture availability and both local rainfall accumulations and the nature of the terrain.

**N80-12547#** Geological Survey, Reston, Va.
**U. S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: BEAVER CREEK WATERSHED**
Janet Bonner, comp. 1979 89 p refs
(PB-297442/6) Avail: NTIS HC A05/MF A01 CSCL 08B

Remotely sensed data gathered from spacecraft and aircraft is presented. GRA

**N80-13606#** Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
**DEVELOPMENT OF AN AIRBORNE GAMMA RADIATION SYSTEM FOR SNOW SURVEYS**
Allen E. Fritzsche 1979 10 p refs Presented at Workshop on Remote Sensing of Snow and Soil Moisture by Nucl. Techniques, Voss, Norway, 23 Apr. 1979
(Contract EY-76-C-08-1183)
(EGG-1183-1679; CONF-790495-1) Avail: NTIS HC A02/MF A01

The use of NaI(T1) gamma detectors with a full gamma energy spectrum pulse height analyzer together with a small computer provides a self contained and flexible system for snow surveys. The dual detector method determines atmospheric radon perturbations in the detection system. Detailed calibration experiments must be performed to determine twenty parameters that describe the physical nature of the system. Multiple high altitude and lake flights are used to obtain background components. Simulation pads, loaded with varying concentrations of K-40, Th-232, and U-238, yield photopeak stripping coefficients and basic system sensitivity. Multiple altitude flights over land lines provide air attenuation coefficients which may be converted to water attenuation coefficients. DOE

**N80-13609#** World Meteorological Organization, Geneva (Switzerland). Hydrology and Water Resources Dept.
**SPACE OBSERVATIONS FOR WATER RESOURCES: A POTENTIAL TO BE DEVELOPED**
A. J. Askew and J. Nemec 1978 14 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979
Avail: NTIS HC A02/MF A01

Information is presented concerning the data requirements that were established for work in hydrology and water resources and mention is made of the use of spacecraft for the transmission of hydrological data. It was concluded that a dialogue should be established between those supplying the data and investigating their potential uses and those actually engaged in the assessment and management of water resources. Author (ESA)

**N80-13611#** Zurich Univ. (Switzerland). Dept. of Geography.
**SNOW MAPPING FROM SPACE PLATFORMS**
K. I. Itten 1979 23 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979 Submitted for publication
Avail: NTIS HC A02/MF A01

Present knowledge of snow mapping from space is reviewed, discussing the problems of optimum resolution, periodicity, features to be measured, and wavelength bands to be used. The requirements for analog and digital data analysis are described, recommendations given, and questions on the economic implementation of such methods raised. It is concluded that the various newly developed satellites for meteorology, Earth and marine resources do not yet constitute a major breakthrough in solving the task of snow mapping. Author (ESA)

**N80-13726#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Abt. Meerestechnik.
**STRATEGIES FOR THE SURVEILLANCE OF COASTAL WATERS OF THE FEDERAL REPUBLIC OF GERMANY Final Report**
Helmut Kosche Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 181 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-77-11) Avail: NTIS HC A09/MF A01; ZLDI, Munich DM 37,80

Strategies for surveillance of anorganic and organic pollutants in coastal waters are necessary to fulfill international conventions. The development of a realistic strategy for the surveillance of low and slowly changing concentration levels is intended. The analysis of collected data show that the knowledge of anorganic pollutants surpasses the knowledge of organic pollutants. The necessary detection limits are in the range of ppb for anorganic and ppt for organic pollutants. Existing measuring devices are presented and discussed with regard to their useful ranges and merits. In addition, the possible potential and use of biological indicators as well as of remote sensing is discussed. The resulting, proposed strategy consists of a three element approach (coordination of existing activities, installment of a central institution, special activities regarding accidents with pollutants) based on sampling, preparation, the use of laboratories, and scientific interpretation. Author (ESA)

**N80-15447*#** Ministero dell'Agricoltura e delle Foreste, Rome (Italy).
**TOPOGRAPHICAL CHARACTERISTICS THROUGH THE STUDY OF THE THERMAL AND HYDROLOGICAL DISUNIFORMITY OF THE SOIL FROM THE MESOSCALE. AN APPPLICATION TO LOCAL FORECASTING OF AMBIENT TEMPERATURE FROM THE TELLUS PROJECT [IL TELERILEVAMENTO PER LO STUDIO A MESOSCA LA DELLE DISUNIFORMITA TERMICHE ED IDRICHE DEL SUOLO. APPLICAZIONE ALLA PREVISIONE LOCALE DEI TEMPORALI NELL'AMBITO DEL PROGETTO TELLUS]**
E. Rosini and P. Caponigro, Principal Investigators 1977 6 p In ITALIAN ERTS
(E80-10020; NASA-CR-162392) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-15533*#** Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
**HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Aug. - 31 Oct. 1979**
Ray D. Jackson, Principal Investigator 31 Oct. 1979 1 p ERTS
(NASA Order S-40255-B)
(E80-10039; NASA-CR-162450) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-15546#** National Ocean Survey, Rockville, Md. Office of Marine Technology.
**TECHNICAL PAPERS ON AIRBORNE LASER HYDROGRAPHY Technical Memorandum, Mar. - Dec. 1978**
Gary C. Guenther, Robert W. L. Thomas (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.), Lowell R. Goodman, David B. Enabnit, and Robert N. Swift (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.) Feb. 1979 74 p refs
(PB-299321/0; NOAA-TM-NOS-25; NOAA-79072309) Avail: NTIS HC A04/MF A01 CSCL 08J

Early results of an experimental and theoretical investigation into the technical aspects of airborne laser bathymetry are presented in the following papers: (1) Laser Bathymetry for Near-Shore Charting Application (A Status Report); (2) Laser Hydrography; (3) Bathymetry Intercomparison: Laser vs. Acoustic; (4) Laser Application for Near-Shore Nautical Charting; (5) Laser Bathymetry for Near-Shore Charting Application (Preliminary Field Test Results); and (6) Theoretical Characterization of Bottom Returns for Bathymetric Lidar. GRA

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# 07

# DATA PROCESSING AND DISTRIBUTION SYSTEMS

**Includes film processing, computer technology, satellite and aircraft hardware, and imagery.**

**A80-10173** # **Some aspects of determining object coordinates from scanner photographs (Nekotorye aspekty opredeleniia koordinat ob'ektov po skanernym snimkam).** O. I. Egorovia. *Geodeziia i Aerofotos'emka,* no. 3, 1979, p. 88-92. In Russian.

The paper presents an analytical method for determining object coordinates from photographs obtained from an infrared line-scanning system with mechanical scanning, under the condition that the image geometry is known. The method is useful in remote sensing studies of earth resources. B.J.

**A80-10876** **Selection of Landsat MSS data for inventories of earth resources.** F. W. Hilwig (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1979, p. 249-266. 14 refs.

At present, an important problem preceding the application of satellite multispectral scanning (MSS) data for inventory of earth resources surveys is the selection of the most relevant scenes for interpretation purposes. The most promising satellite MSS data for multitemporal studies of earth resources can only be obtained if careful consideration is given to the following factors: cloud cover, image quality, snow cover, bioclimate (soil moisture), vegetation/crops, and sidelap. These factors are necessary for both visual interpretation and digital analysis of Landsat MSS data. As outlined in the paper, a terminal connected to data bases of space imagery, e.g., EROS (USA) or ESRIN (Italy), may speed up the time-consuming iterative process of selection of satellite imagery. A data base, obtained by the coordination, standardization and exchange of data of the various receiving stations, distribution centers and documentation institutes, would be an essential step in optimizing the selection, interpretation and application of satellite MSS data. S.D.

**A80-11190** **Inexpensive radar mapping by Ericsson Slar.** B. Ekengren (LM Ericsson Telefon AB, Molndal, Sweden). In: Military Electronics Defence Expo '78; Proceedings of the Conference, Wiesbaden, West Germany, October 3-5, 1978.
Geneva, Interavia, S.A., 1979, p. 769-777.

The paper examines an inexpensive radar mapping technique employing a real aperture sidelooking airborne radar. The fundamental principles of real aperture SLAR are reviewed, noting that experience has shown that good radar maps can be achieved with radar installed in a light business aircraft without sophisticated antenna stabilization. Attention is given to the following major applications: oil spill mapping, sea ice mapping, ship detection, including supervision of fishing, monitoring of borders, and supervision of sea traffic. In addition, use for land mapping is also covered. It is concluded that such a system is flexible and has high availability. M.E.P.

**A80-11696** # **Advances in digital image display and simulation from digital terrain data bases.** M. B. Faintich, G. B. Sigler, and D. P. Fahy (U.S. Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Mo.). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 111-135.

The digital terrain data produced at the Defense Mapping Agency Aerospace Center (DMAAC) supports a wide variety of products, including input to radar simulators, guidance systems and automated cartographic systems. To facilitate the display of the data bases for analysis, DMAAC has developed the capability for computer generation of digital image displays of the terrain data in the form of gray level elevation coding, contouring, variable sun angle shaded relief and computer generated sensor scenes, including perspective views, stereo-pairs, and synthetic radar displays. All of the examples shown in this paper were generated at DMAAC on a UNIVAC 1000 series computer and reimaged onto film format using an OPTRONICS scanning, digitizing and reimaging (SDR) system. It is shown that digital terrain data bases may be effectively displayed in various image formats. This capability has proven to be a valuable editing and analysis tool for the production and specification refinement of digital terrain data. S.D.

**A80-11697** # **Combined Skylab and high altitude aircraft photography space triangulation.** M. E. O. Ali and A. J. Brandenberger (Université Laval, Quebec, Canada). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 354-373. 6 refs. Research supported by the National Research Council of Canada and Department of Energy, Mines and Resources.

The paper is concerned with an investigation designed to study a combination of high-altitude aircraft photography and Skylab photography aerial triangulation. The discussion covers a brief description of the materials used in the investigation, selection of an appropriate number of control and/or pass points, bundle adjustment algorithm for aerial triangulation of space photography, and tests and results. The various procedures studied and developed produced a planimetric accuracy of approximately 20 m in the best case. Such a ground control accuracy would be sufficient for 1:100,000 mapping and even for 1:50,000 (reconnaissance) mapping. The Skylab photography appears to be useful in areas of the earth where there is no control of any type except the coordinates of some points which can be measured on small-scale maps. S.D.

**A80-11704** # **The SPOT remote sensing satellite - Assessment of the geometric quality of the images.** R. Rosso (Centre National d'Etudes Spatiales, Toulouse, France). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 455-473. 11 refs.

The paper discusses the development and features of the French SPOT remote sensing satellite (SPOT standing for Satellite Probatoire d'Observation de la Terre, i.e., Earth Observation Test Satellite). Attention is given to an assessment of the geometric quality of the images using computer simulation with allowance for the satellite dynamics and ground data processing. The assessment of the geometric quality of the SPOT imagery is made by comparison with usual map projections. The simulation indicated the potential accuracy of the SPOT level 1 images and was effective in defining the ground data processing required. S.D.

**A80-13358** **Computer graphic feature analysis and selection.** J. R. Jensen (Georgia, University, Athens, Ga.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Nov. 1979, p. 1507-1512. 19 refs.

Analysts conducting supervised land-cover classification often rely solely on statistical divergence or separability measures for feature selection. Consequently, they may fail to appreciate the relatively consistent spatial clustering and degree of overlap among training class spectra. A graphic method of analyzing training class statistics is presented which allows analysts to view parallelepipeds in three-dimensional space and interactively vary viewing azimuth and elevation angles for optimum visual examination. Up to three channels may be examined at one time. It is hoped that the graphic method will supplement statistical measures, resulting in improved feature analysis and selection. (Author)

**A80-14047** # **Feature selection via entropy minimization - An example using Landsat satellite data.** A. Zandonelia (Telespazio S.p.A., Rome, Italy) and B. Sellman. *(Convegno sulle Metodologie di Trattamento dell'Informazione, 2nd, Trieste, Italy, Feb. 23, 24, 1979.) Società Astronomica Italiana, Memorie,* vol. 50, Sept. 1979, p. 503-513.

A methodology for enhancing the significant spectral features in Landsat data is introduced. The process, by which significant spectral features are determined, uses a minimum entropy model to guide subsequent analysis efforts. Classification results using traditional and minimum entropy method are presented and discussed. (Author)

**A80-14952** **Simple generation of one-parameter pseudo-terrain surfaces.** G. E. Carlson (Missouri-Rolla, University, Rolla, Mo.) and G. L. Bair (Texas Instruments, Inc., Dallas, Tex.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-15, Sept. 1979, p. 735-738. Navy-supported research.

A simple method for generating digital terrain surfaces as a function of only the terrain standard deviation is presented. This is accomplished by fitting a postulated autocorrelation model to actual terrain data. Observed relations between model parameters are used to obtain a one-parameter model. (Author)

**A80-15772** # **Some examples of the use of satellite imagery /Landsat/ for natural resource mapping in Western Sudan.** D. E. Parry (Hunting Technical Services, Ltd., Boreham Wood, Herts., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 1, 3-12. 15 refs.

The present paper describes the compilation of land systems, geomorphology, soils, vegetation and land use maps of some 80,000 sq km in the Southern Darfur Province of Western Sudan, from 1/250,000 scale color-composite bulk-processed Landsat 1 imagery. Manual methods of interpretation and map compilation were used and backed by field studies. Particular attention is given to the problem of locating interpreted boundaries in the field and other practical constraints likely to be encountered when using satellite imagery for regional studies in remote and inaccessible areas. The mapping examples include a comparative study of resource maps compiled from conventional aerial photography and ground survey with those compiled from satellite imagery of a part of the survey area. (Author)

**A80-15773** # **The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory.** C. J. Lawrance (Department of the Environment, Transport and Road Research Laboratory, Crowthorne, Berks., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 13, 15, 16.

The practice of using aerial photographs to map terrain and materials is well established, but the ability of land classification to predict soil conditions is most successful in areas of stable geomorphic environment, dry climate, simple geology and bold relief. Ethiopia for the most part possesses these attributes, and has, therefore, been the subject of a high level terrain classification at 1:2 million, using Landsat imagery. Geological, topographic and soils maps, and local experience provided background information. Sixty-seven 'natural regions' were defined, describing the geology, topography, climate and drainage of each region, with comments on engineering soils and construction materials. The space imagery provided detail that was impossible to achieve by any other means, but a limitation was found to be the lack of resolution at the small scale used. A scale of 1:1 million or 1:500,000 would have considerably aided interpretation. (Author)

**A80-20265** **Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington.** R. B. Scott and T. W. D. Gregg (Washington, Dept. of Natural Resources, Olympia, Wash.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 504-511. 9 refs.

A program involving the use of aerial photography and remote sensing data for resouce management is detailed. The program, adopted by the Department of Natural Resources of the State of Washington, includes the acquisition, at various scales and emulsion types, of photographs of over 70 percent of the State on a 8-10 year schedule. Nearly a quarter of a million photographs dating back 25 years are on file now. Some applications of this multidata photography are: monitoring forest resource and forest management activities, forest fire detection, and monitoring beds of navigable waters and trespass in harbor areas. Remote sensing data collected by thermal scanning sensors are used for fire spotting and mapping, and multispectral Landsat data are used for forest inventory and productivity monitoring. V.L.

**A80-20269** * **Multiple-frame, full resolution Landsat mosaicking to standard map projections.** A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 608-616. 7 refs. Contract No. NAS7-100.

Landsat digital data are presently available by frames whose size and location are determined by satellite orbit. The utility of Landsat data was increased by the image processing support for JPL's planetary program which provided the basic software and procedures necessary for image mosaicking. The computer software has been extended to perform this task on Landsat Multi-spectral scanner imagery and a ten frame digital mosaic of the Southern California desert has been completed. Major processing steps include location of geographic points in the digital frame and of common geographic points in adjacent frames, conversion to a map projection, lateral 'rubber sheet' correction of the digital frames, brightness correction of adjacent frames, and mosaicking of the frames to eliminate overlap and produce a single large frame. (Author)

**A80-15781** # **The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java.** A. H. J. Meijerink and N. H. W. Donker (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 75, 77-83. 13 refs.

An approach to digital processing, as developed at ITC, is outlined and examples of its application to the Himalayas and Central Java are given. The central theme in the approach is the reduction of the dimensionality for generating color coded hard copies for interpretation and for carrying out automatic classification. Methods to achieve this aim are discussed. Black box methods are avoided and the interpreter guides all steps of the procedures by using the reduced feature space as a medium for decisions. As applied to land-use mapping of complex areas in the developing countries, the results indicate that where automatic classification partly fails visual interpretation, transfer of data from other sources, or temporal data, can be done in the same line of operations. In both test areas the processed imagery form excellent base maps for incorporating results of selected field traverses. (Author)

**A80-17514** **Digital processing of aerial images; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979.** Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by T. F. Wiener (U.S. Defense Advanced Research Projects Agency, Arlington, Va.) and E. L. Hall (Tennessee, University, Knoxville, Tenn.). Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 186), 1979. 272 p. $30.
A80-17540)

This volume addresses problems associated with achieving image recording in the face of various types of distortion. Papers reporting recent and ongoing research and development activity in techniques and analysis, devices and systems, as well as future concepts, are presented. Six problem areas are considered: scene matching (two sessions), aerial image techniques, digital processing of aerial images, image understanding, feature operators, and synthetic reference image preparation. Topics of interest include scene matching with feature detection, optimum filters and windows for image registration, computer modeling of optical trackers, performance evaluation of image correlation techniques, measuring scene content from aerial images, edge and line enhancement by adaptive lattice filtering, and automatic stereo reconstruction of manmade targets. S.D.

**A80-19542** **Multispectral aerial photography for wetland vegetation mapping.** W. G. Howland (McGill University, Montreal, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Jan. 1980, p. 87-99. 19 refs.

Vegetation in a variety of wetland types in the Shelburne Pond, Vermont area was mapped using small scale aerial photographs. Color infrared, conventional color, and black-and-white multi-band photographs were studied using a zoom stereoscope and additive color enhancement techniques. The floristic composition of plant canopy associations and corresponding recognition characteristics are presented. Emphasis is given to ground control and a familiarity with plant ecology, as requisite elements in the interpretive process. Selected observations are made regarding the ecological significance of signature pattern. Film types were evaluated based on three parameters: association discrimination, size of minimum mapping unit, and ease of interpretation. Color infrared was found superior for this application, and conventional color was better than the color enhanced multi-band, which was at much smaller scale. However, the color enhanced multi-band imagery did offer more information about some plant groups than did color, especially where long wave reflectance was a key recognition element. The use of actinic infrared is recommended for future wetland vegetation investigations. (Author)

**A80-19923** # **Orientation problem of SLAR imagery.** A. Okamoto (Kyoto University, Kyoto, Japan). *Kyoto University, Faculty of Engineering, Memoirs,* vol. 41, July 1979, p. 293-307. 6 refs.

This report treats the orientation and restitution problem of SLAR imagery theoretically. The orientation problem is discussed for both single and stereo SLAR configurations. For the former, an analytical orientation method constructed on the geometrical basis of SLAR imagery already studied is proposed. For the latter, an orientation technique is developed to calculate the exterior orientation parameters of the antenna for stereo SLAR imageries simultaneously. With this method the analysis of SLAR imagery may be performed three-dimensionally and more accurately than before. In both cases, some functional form, such as polynomials or Fourier series, is used to model the behaviors of the exterior orientation elements of the antenna along the flight path, as in the analysis of MSS imagery. By linearizing the equations for the orientation problem of single SLAR imagery, error equations for the restitution problem of SLAR imagery are obtained. Simple restitution methods of SLAR imagery for a flat terrain and also for a hilly ground surface are introduced, and some characteristics are clarified. (Author)

**A80-20237** **American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978. Proceedings.** Falls Church, Va., American Society of Photogrammetry, 1978. 624 p.

The papers deal with the application of aerial-photography, image-scanning, thermal infrared remote sensing, multidate photography, and radar technologies to environmental monitoring, digital mapping, and other photogrammetric applications. Among the topics covered are: the principles of thermal infrared remote sensing for heat cost determination; aerial photographic methods for the detection of submerged vegetation; remote sensing for monitoring resources for development and conservation of desert and semi-desert areas; a long-wave radar for geological analysis of vegetated terrain; densitometry in photogrammetry; and microprocessor and minicomputer assisted photogrammetric systems. V.P.

**A80-20252** **The National Map Accuracy Standards in the context of mapping with imagery data.** S.-Y. Hsu (New York, State University, Binghamton, N.Y.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 296-301. 12 refs.

Compared to certain European countries, the United States National Map Accuracy Standards are by far the loosest. Even so the thematic maps in the United States have not been designed to meet the standards. The technological advancements in remote sensors, photogrammetric instruments, digital precision processing have laid a sound foundation for producing base maps that meet the standards for thematic mapping. The Landsat imagery at the scale of 1:250,000 is one of the excellent resources for preparing a new generation of precision thematic maps. To reach this goal, it is proposed that a rule be established requiring the cartographer to label in the map legends whether efforts have been made to utilize precision base maps for preparing the thematic map. (Author)

**N80-10538*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**APOLLO-SOYUZ TEST PROJECT. VOLUME 2: EARTH OBSERVATIONS AND PHOTOGRAPHY**
Farouk El-Baz, ed. (Smithsonian Institution) and D. M. Warner, ed. (Smithsonian Institution) Washington 1979 700 p refs
Original contains color illustrations 2 Vol.
(Contract NAS9-13831)
(NASA-SP-412-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 05B

Visual observations of the earth are presented along with the corresponding photographs and maps for specific regions.

**N80-10539*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**SUMMARY OF SIGNIFICANT RESULTS**
Farouk El-Baz (Smithsonian Institution), Delia M. Warner, and R. Thomas Giuli *In its* Apollo-Soyuz Test Project. Vol. 2 1979 p 1-8 ref
Avail: NTIS HC A99/MF A01 CSCL 05B

A summary of the visual and photographic study of specific earth features is presented. The areas selected were in the fields of geology, desert studies, oceanography, hydrology, and meteorology. F.O.S.

**N80-10561*#** Smithsonian Institution, Washington, D. C.
**DETERMINING PHOTOGRAPH LOCATIONS OVER OCEANS**
S. McLafferty, M. Pryslak, and G. A. Maul (NOAA) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 359-370 refs
Avail: NTIS HC A99/MF A01 CSCL 08J

The methods used to quantitatively define the photo-locations of ocean photographs taken from the Apollo Soyuz spacecraft are described. They are based on photogrammetry, on a knowledge of the groundtracks of the spacecraft and the times during which the photographs were taken, and on a comparison with satellite imagery. Latitudes and longitudes with an estimated error of + or - 1 to + or - 3 seconds are calculated for the center points of photographs taken during mapping passes that lack photo-support data. A method is developed for determining the center points for photographs containing two or more recognizable features on landmasses. A map is provided which shows the Apollo groundtracks that correspond to the times when the photographs were taken. M.M.M.

**N80-11534#** Naval Ocean Systems Center, San Diego, Calif.
**PROCESSING AND DISPLAY TECHNIQUES FOR MULTISPECTRAL SATELLITE IMAGERY Final Report, 1 Feb. - 30 Sep. 1978**
J. A. Roese Apr. 1979 39 p refs
(AD-A072509; NOSC/TR-439) Avail: NTIS HC A03/MF A01 CSCL 09/2

In recent years, the technology area of remote sensing by multispectral satellite sensors has evolved greatly. Imagery obtained by satellite means has been the basis for much work in the areas of environmental studies, resource planning, terrain mapping, weather prediction and military reconnaissance. This program effort has investigated the application of various image processing and display techniques for use with multispectral satellite imagery. Emphasis has been placed on the development and implementation of two-dimensional processing techniques applied in the domain of the original image. Two-dimensional transform domain image processing and display techniques were also adapted for use with satellite imagery. GRA

**N80-12487** Technische Hochschule, Darmstadt (West Germany). Fachgebeit Fernerkundung und Photointerpretation.
**ON MEASUREMENTS FROM AIRCRAFT Final Report**
Joerg Albertz and Manfred Schroeder Jun. 1978 505 p refs In GERMAN; ENGLISH summary Presented at Symp. Airborne Sensing Programme, Hanover, 29-31 Aug. 1977 Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Germany
(Contract BMFT-WE-0175)
(BMFT-FB-W-78-04) Avail: Issuing Activity

Some fifty papers are presented on the techniques developed and applied in the framework of the German remote sensing program pursued during the 1975 to 1977 period. Airborne multispectral imaging techniques were applied to the following disciplines: oceanography and coastal processes, urban and regional management, agriculture and forestry, geology and hydrology. Intensive research work in the fields of digital image processing and the spectral signatures of natural surfaces were associated with this program.

**N80-12505** Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).
**DIGITAL PROCESSING PROCEDURE FOR TEXTURE ANALYSIS WITH REMOTE SENSING DATA [VERFAHREN DER DIGITALEN BILDVERARBEITUNG ZUR TEXTURANALYSE VON FERNERKUNDUNGSDATEN]**
B. Bargel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 371-378 refs In GERMAN

Avail: Issuing Activity

Specific texture parameters were determined and an appropriate combination of parameters was selected in order to classify objects with the use of multispectral analysis. Forest and built-up regions were investigated. The methods employed involve gray scale evaluations, differenciating image data, line information and Fourier spectrum techniques. Preprocessing and image transformation procedures are applied. Some concrete examples and their treatments are presented. Author (ESA)

**N80-13592*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**EARTH OBSERVATIONS DIVISION EARTH RESOURCES DATA ANALYSIS CAPABILITIES**
F. Tragni, Principal Investigator Jul. 1979 86 p refs Revised EREP
(Contract NAS9-15800)
(E80-10013; NASA-CR-160339; LEC-3949-Rev-D; JSC-16030-Rev-D) Avail: NTIS HC A05/MF A01 CSCL 05B

**N80-13596*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**TEXAS APPLICATIONS SYSTEM VERIFICATION AND TRANSFER REMOTE SENSING INFORMATION SUBSYSTEM: FUNCTIONAL DESIGN**
M. L. Brown, Jr., Principal Investigator, A. M. Fails, M. V. Martin, A. S. Story, and E. A. Weisblatt Mar. 1979 405 p EREP
(Contract NAS9-15800)
(E80-10017; NASA-CR-160342; LEC-13258; JSC-14785)
Avail: NTIS HC A18/MF A01 CSCL 05B

**N80-15478*#** Lockheed Electronics Co., Houston, Tex.
**CONSIDERATIONS FOR DESIGN OF FUTURE RESEARCH AND DEVELOPMENT INTERACTIVE IMAGE ANALYSIS SYSTEMS**
T. B. Wilkinson, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 333-344 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Future interactive image analysis systems must provide for the increased processing requirements imposed by a thermal channel to LANDSAT-3 and the increased number of spectral channels with significantly higher spatial resolution provided by the LANDSAT-D thematic mapper. Other design considerations must include the rapidly changing technology in memories and special purpose processors, as well as the analyst-machine interface and the human factors involved. The centralized and distributed system approaches are examined in relation to the optimum design configuration of future systems. A.R.H.

**N80-15493*#** Texas A&M Univ., College Station.
**ON THE CLUSTERING OF MULTIDIMENSIONAL PICTORIAL DATA**
J. D. Bryant, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 647-659 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS9-14689)
Avail: NTIS HC A99/MF A01 CSCL 02C

Obvious approaches to reducing the cost (in computer resources) of applying current clustering techniques to the problem of remote sensing are discussed. The use of spatial information in finding fields and in classifying mixture pixels is examined, and the AMOEBA clustering program is described. Internally, a pattern recognition program, from without, AMOEBA appears to be an unsupervised clustering program. It is fast and automatic. No choices (such as arbitrary thresholds to set split/combine sequences) need be made. The problem of finding the number of clusters is solved automatically. At the conclusion of the program, all points in the scene are classified; however, a provision is included for a reject classification of some points which, within the theoretical framework, cannot rationally be assigned to any cluster. A.R.H.

**N80-15495*#** Lockheed Electronics Co., Houston, Tex.
**CLASSY: AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING ALGORITHM**
R. K. Lennington and M. E. Rassbach, Principal Investigators (Elogic, Inc., Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 671-689 refs ERTS
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

The CLASSY clustering method alternates maximum likelihood iterative techniques for estimating the parameters of a mixture distribution with an adaptive procedure for splitting, combining, and eliminating the resultant components of the mixture. The adaptive procedure is based on maximizing the fit of a mixture of multivariate normal distributions to the observed data using its first through fourth central moments. It generates estimates of the number of multivariate normal components in the mixture as well as the proportion, mean vector, and covariance matrix for each component. The basic mathematical model for CLASSY and the actual operation of the algorithm as currently implemented are described. Results of applying CLASSY to real and simulated LANDSAT data are presented and compared with those generated by the iterative self-organizing clustering system algorithm on the same data sets. A.R.H.

**N80-15496*#** Houston Univ., Tex.
**LINEAR FEATURE SELECTION WITH APPLICATIONS**
H. P. Decell, Jr. and L. F. Guseman, Jr., Principal Investigators (Texas A and M Univ., College Station) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 691-703 refs ERTS

(Contracts NAS9-15000; NAS9-14689)
Avail: NTIS HC A99/MF A01 CSCL 02C

Several ways in which feature selection techniques were used in LACIE are discussed. In all cases, the methods require some a priori information and assumptions; in most, the classification procedure (Bayes optimal) was chosen in advance. The transformations used for dimensionality reduction are linear, that is, the variables in feature space are always linear combinations of the original measurements. Several numerically tractable criteria developed for LACIE, which provide information about the probability of misclassification, are discussed. Recent results on linear feature selection techniques are included. Their use in LACIE is discussed. Related open questions are mentioned. A.R.H.

**N80-15508*#** Lockheed Electronics Co., Houston, Tex.
**IMAGE AND NUMERICAL DISPLAY AIDS FOR MANUAL INTERPRETATION**
R. A. Abotteen, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 911-921 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Four color image display techniques, developed to aid in interpreting LANDSAT imagery, are described. These are the cluster image, the principal component transformation, the principal component greenness transformation, and the color-coded spectral plot. Experimental results show that the four techniques are useful in selecting and/or identifying representative samples of signatures in a given LANDSAT scene. A.R.H.

**N80-15540#** Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
**CONCEPT DEVELOPMENT OF AUTOMATED IMAGE ANALYSIS. AUTOMATED CONTOUR RECOGNITION AND CLASSIFICATION IN AERIAL PHOTOGRAPHY BY MEANS OF ANGLES AND CURVATURE Final Report**
Henning F. Harmuth 31 Aug. 1979 96 p refs
(Contract DAAK70-78-C-0147)
(AD-A074439; ETL-0194) Avail: NTIS HC A05/MF A01 CSCL 09/4

The automated contour recognition and classification in aerial photography requires a feature of contours that is invariant to shift, rotation and scaling. General polygons are characterized by their angles and their normalized sides. The normalization of the sides may be achieved by dividing either with the longest side or with the circumference of the polygon. For a curved contour, the simplest invariant under shift and rotation is the curvature. To make the curvature invariant to scaling, one may divide it by the largest curvature or multiply it with the length of the contour; the multiplication with the length of the contour is better because of the finite resolution of photographs and equipment. The principle of contour recognition and classification based on angles and curvature is worked out for practical displays that produce square patterns, such as liquid crystal or plasma tube displays. The mechanical and electronic design for experimental equipment is carried out based on a plasma tube display with 512 x 512 resolved points. GRA

**N80-15547#** Geological Survey, Reston, Va.
**US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT ALEUTIAN ISLANDS NATIONAL WILDLIFE RANGE. PROJECT 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN**
Janet Bonner, comp. 1979 45 p
(PB-297931/8) Avail: NTIS HC A03/MF A01 CSCL 08G

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest cover, water area, and other diagnostic landscape features. Each data report lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

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# 08

# INSTRUMENTATION AND SENSORS

**Includes data acquisition and camera systems and remote sensors.**

**A80-14196** # **Airborne semiconductor radiometers (Samoletnye radiometry na poluprovodnikovykh priborakh).** A. G. Semin, Iu. B. Khapin, and A. N. Sharapov. *Radiotekhnika,* vol. 34, Sept. 1979, p. 42-45. In Russian.

A number of microwave superheterodyne semiconductor radiometers with input mixers have been developed for remote sensing of the atmosphere and underlying surfaces. The radiometers operate at frequencies of 89, 37, and 20 GHz. This paper presents a brief description of radiometer units and subunits. B.J.

**A80-15489** **India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR'.** C. P. N. Calla, G. Raju, S. S. Rana, and S. Balasubramanian (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). *Institution of Electronics and Telecommunication Engineers, Journal,* vol. 25, Aug. 1979, p. 321-324.

This paper describes the first remote sensing data obtained from the indigenous satellite, 'BHASKARA', using a passive microwave remote sensor. The payload, Satellite Microwave Radiometer (SAMIR), is a three-channel microwave radiometric system, two of them operating in the 19-GHz band and the third in the 22-GHz band. SAMIR is one of the primary payloads on-board Bhaskara and its chief objectives are investigations of sea state, water vapor and liquid water content in the atmosphere and over the oceans adjoining the Indian subcontinent. The overland data gives synoptic information to soil moisture, snow cover and biomass studies of interest to applications in earth resources. The characteristics of the payload and the data obtained in the initial operations of the satellite are presented. (Author)

**A80-20266** **Cooperative methods for acquisition of aerial photography.** R. B. Scott, T. W. D. Gregg, and R. E. Heft (Washington, Dept. of Natural Resources, Olympia, Wash.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 512-521.

The paper deals with a unique aerial photographic acquisition program that contracts the collection of several scales of photography over approximately seventy percent of the state on a repetitive basis. The program is designed to provide a wide range of photographic products to meet the needs of resource managers at a reduced cost. The discussion covers the history and evolution of the program, types of photographic materials collected, cooperative aspects and advantages, and the administration of the program. V.P.

**A80-16559** **Remote-sensing studies of taiga regions (Issledovanie taezhnykh landshaftov distantsionnymi metodami).** Edited by A. S. Isaev. Novosibirsk, Izdatel'stvo Nauka, 1979. 222 p. In Russian.

The papers deal with applications of remote sensing from aircraft and satellites to the surveying of extended taiga regions. Some aspects of the theory of landscape-structural interpretation of satellite imagery are reviewed, and mathematical methods of processing information obtained from image interpretation are outlined. Attention is given to methodological aspects of mapping extended forest and marsh areas, soils, and fire devastated regions. V.P.

**A80-16568** # **Analysis of the spectral reflection characteristics of natural formations in remote sensing studies (Analiz spektral'nykh otrazhatel'nykh kharakteristik prirodnykh obrazovanii pri distantsionnom issledovanii).** I. A. Petrakovskii, R. G. Khlebopros, and A. S. Isaev. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 201-213. 28 refs. In Russian.

The use and current status of multispectral recognition techniques for conducting wide-area environmental surveys are examined. It is shown that the difficulties arising due to changes in the reflection coefficient of a test site, caused by changes in position of the sun, can be eliminated by measuring the reflected radiation in a direction antiparallel to the direct solar rays. V.P.

**A80-17431** * **Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer.** F. M. Zweibaum (Barnes Engineering Co., Stamford, Conn.) and E. W. Chapelle (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Real-time signal processing II; Proceedings of the Seminar, Washington, D.C., April 19, 20, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 242-255.

A standard high-speed, field-portable spectroradiometric measurement system built around a programmable microprocessor has been adapted to the form of a Reflectometer/Comparator. In this configuration, the instrument makes passive measurements of the absolute reflectance of agricultural plant canopies over a spectral range of 0.4 to 2.5 micrometers. Real-time absolute measurements are made possible by an optical chopper which constantly compares the target with the sun, and makes extensive measurements of solar reflectance from a variety of these targets. The paper describes the instrumentation and measurement procedures, reviews the software programming and discusses the results. (Author)

**A80-17460** * **Thematic mapper design description and performance prediction.** J. C. Lansing, Jr., T. D. Wise (Santa Barbara Research Center, Goleta, Calif.), and E. D. Harney (Hughes Aircraft Co., El Segundo, Calif.). In: Space optics; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 224-234. Contract No. NAS5-24200.

The new generation of satellite-borne earth resources scanners, the Thematic Mapper, is being built for launch on the Landsat-D spacecraft. It will gather data for applications such as crop inventory, land use planning, forest management, and geology. This paper gives an overall design description, further discussion of principal design features, performance achievements where data are available, and system performance predictions. (Author)

**A80-17462** * **Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s.** C. C. Schnetzler and L. L. Thompson (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Space optics; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 255-262.

An experimental pushbroom scan sensor, the Multispectral Resource Sampler (MRS), being developed by NASA for a future earth orbiting flight is presented. This sensor will provide new earth survey capabilities beyond those of current sensor systems, with a ground resolution of 15 m over a swath width of 15 km in four bands. The four arrays are aligned on a common focal surface requiring no beamsplitters, thus causing a spatial separation on the ground which requires computer processing to register the bands. Along track pointing permits stereo coverage at variable base/height ratios and atmospheric correction experiments, while across track pointing will provide repeat coverage, from a Landsat-type orbit, of every 1 to 3 days. The MRS can be used for experiments in crop discrimination and status, rock discrimination, land use classification, and forestry. A.T.

**A80-17463** **Array technology as applied to future earth resources sensors.** J. A. Hall and D. H. McCann (Westinghouse Defense and Electronic Systems Center, Baltimore, Md.). In: Space optics; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 263-272.

Schnetzler and Thompson have described the multispectral resource sampler - a visible and near visible sensor system for spaceborne assessment of earth resources, based on established technologies. In the present paper, it is shown how established technologies can be used to design an advanced earth resource sensor system in the 1985-1990 time frame. V.P.

**A80-17515** **Geometric preprocessing of sensor data used for image matching.** J. E. Berry and J. K. Yoo (Goodyear Aerospace Corp., Akron, Ohio). In: Digital processing of aerial images; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 2-11. 11 refs. Grant No. DAAK40-77-C-0107.

Preprocessing that enables accurate matching of two images taken by sensors located at different points in space is presented. Separation between the sensors results in perspective changes that appear as geometric distortion. Two methods for removing the distortion are described. One method applies to sensors that measure range. The second method applies to sensors that do not measure range. Descriptions of the applicable sensor data formats, rationale for the preprocessing approaches and transformations used to implement the approaches are included. Examples comparing images before and after preprocessing are shown. (Author)

**A80-18774** **The reduction and analysis of satellite magnetometer data.** R. D. Regan (Phoenix Corp., McLean, Va.). *Geophysical Surveys,* vol. 3, Dec. 1979, p. 331-349. 18 refs.

The paper considers the reduction and interpretation of satellite magnetometer data and details its morphology. These data are useful in the compilation, reduction, and analysis of magnetic survey data; suitable analysis such as screening and reduction to common altitude and inclination and consideration of the vector nature of the background field can provide valuable information for crustal studies. However, the reduction and interpretation techniques for satellite magnetometer measurements differ from methods applied to conventional data; they require modifications of several standard techniques although the unequal spacing, in three dimensions, of the satellite data and the variation in direction and intensity of the main geomagnetic field pose some interpretation problems. The variation in altitude of the satellite measurements can also be used in some analyses. A.T.

**A80-20244 *** **Using airborne radiometry to determine atmospheric effects in Landsat data.** R. W. Dana (U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 117-129. 10 refs. NASA Order S-54053-A.

An empirical method was developed to measure how solar and atmospheric conditions affect Landsat images by comparing Landsat MSS data with terrain reflectance. Terrain reflectance was measured with a four-channel radiometer designed to measure radiance in wavelength bands matched to the Landsat MSS data. Other instrumentation included a digital data logger, an irradiance meter, and a video camera with recorder. Reflectance of many terrain elements which could be registered to the Landsat digital data were measured from a low-flying aircraft. Correlations of reflectance with Landsat radiance verified a linear atmospheric model with an additive (path radiance) term and a multiplicative (transmittance) term. Coefficients from this model permit the extension of spectral signatures in computer-aided classification of Landsat images. (Author)

**A80-20250** **The PDS differential rectifier - An economical approach to digital orthophotos.** J. Horton (Perkin-Elmer Corp., Applied Optics Div., South Pasadena, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 264-282.

The digital sampling and playback capabilities of the PDS Microdensitometer are utilized to differentially rectify photographic images to produce orthophotos, stereomates, and other simulated-perspective reconstructions. A method is described whereby the input imagery can be non-orthogonally scanned, eliminating the necessity of resampling the digitized pixel data, and thus enabling high-resolution reconstructions while obviating the need for a large capacity, therefore expensive, control computer. Examples are given of the performance which can be expected of this system, in terms of resolution vs. thruput. (Author)

**N80-11547#** Technical Research Centre of Finland, Espoo. Lab of Land Use.

**AUTOMATED EARTH RESOURCES SURVEYS USING SATELLITE AND AIRCRAFT SCANNER DATA: A FINNISH APPROACH**

Einari Kilpelae, Sipi Jaakkola, Risto Kuittinen, and Jouko Talvitie 1978 174 p refs Co-Sponsored by Finn. Natl. Fund for Res. and Develop., Acad. of Finland, Found. for Res. of Nat. Res., Min. of Trade and Ind., Sci. Comm. of Natl. Defence Original contains color illustrations
(VTT-LU-15; ISBN-951-38-0723-1) Avail: NTIS HC A08/MF A01

A tree-year multidisciplinary earth resources oriented remote sensing project was carried out to develop automated environment monitoring and natural resources inventory methods for Finnish conditions and to study the technical feasibility of such methods in the fields of water resources, geology, agriculture, and forestry. Both satellite (LANDSAT) and aircraft scanner data from several test sites in southern Finland were used in the study. Data acquisition and analysis procedures as well as the results obtained are discussed. The results justify more detailed remote sensing research on various problems in all fields cited.
Author (ESA)

**N80-12034#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

**SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD**

Jean Besson, Andre Girard, Marcel Ackerman, and Dirk Frimout (Inst. of Space Aeronomy, Brussels) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 77-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestrial (Paris) no. 1978-6, Nov. - Dec. 1978 p 343-353 Presented at 29th Intern. Congr. of Astronautics, Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11279

Avail: NTIS HC A06/MF A01

The grille spectrometer for measuring stratospheric and mesospheric composition, which will be mounted on board permits infrared measurements of active atmospheric constituents in the altitude range where their local concentration is higher than 100 million mol/cu cm. The instrument operates in two modes: in absorption with the sun as a source and in emission in the spectral ranges corresponding to the thermal emission of atmospheric gases. The instrument consists of a sighting system (tiltable front mirror), a radiation collector, a monochromator with output optics and detectors, and electronic subassemblies for the instrument command and its connection with the Spacelab electronic system.
Author (ESA)

**N80-12468** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

**AIMS AND TASKS OF THE AIRCRAFT TEST PROGRAM [ZIELE UND AUFGABEN DES FLUGZEUGMESSPROGRAMS]**

Manfred Schroeder *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 11-22 refs In GERMAN

Avail: Issuing Activity

Studies were carried out for developing German remote sensing equipment for future participation in international satellite projects for global and regional environmental monitoring systems. Emphasis is given to work in the following fields: multispectral imaging techniques, development of systems for the digital treatment of images, applications to geoscience problems, evaluations for future technological developments, balanced organizational and interdisciplinary teams. Author (ESA)

**N80-12469** Technische Universitaet, Hanover (West Germany).

**ON THE CURRENT STATE OF REMOTE SENSING TECHNIQUES [ZUM GEGENWAERTIGEN STAND DER FERNERKUNDUNG]**

G. Konecny *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 23-36 refs In GERMAN

Avail: Issuing Activity

Several different aspects of current work are discussed: radiation characteristics of various objects, choice of sensors, choice of platform, data processing (analog and digital), and the handling and interpretation of complex information. A specific problem which benefits from the exploitation of such techniques is then exposed: the Jade coast region. The economic importance of the region is underlined. It is concluded that a high resolution thermal sensor and an even higher resolution optical sensor are invaluable for coastal water and engineering studies.
Author (ESA)

**N80-12515** Freiburg Univ. (West Germany).

**THE MULTISPECTRAL SCANNER AS AN INSTRUMENT FOR SIGNATURE DETERMINATIONS**

P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 459-470 refs In GERMAN

Avail: Issuing Activity

The identification of objects by multispectral scanning supposes a knowledge of the spectral reflection characteristics of the surface investigated. The determination in situ of these characteristics has the disadvantage of requiring considerable apparatus and employing systems that enable only a few objects to be measured in a working day. A method of overcoming this difficulty is described, which enables various different objects in different regions to be studied under different image conditions. Examples are given.
Author (ESA)

**N80-12530*#** Texas A&M Univ., College Station. Remote Sensing Center.

**THE SYSTEM AND HARDWARE DESIGN OF REAL-TIME FAN BEAM SCATTEROMETER DATA PROCESSORS Final Report**

John P. Claassen, Robert O. Stroud, Billy V. Clark, B. Randall Jean, and Richard W. Newton, Principal Investigator Mar. 1979 286 p refs EREP
(Contract NAS9-15311)
(E80-10028; NASA-CR-160350; RSC-3556) Avail: NTIS HC A13/MF A01 CSCL 14B

**N80-12533*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**EXAMINATION OF LAMBERTIAN AND NON-LAMBERTIAN MODELS FOR SIMULATING THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA**

Chris Justice and Brent N. Holben Sep. 1979 25 p refs
Submitted for publication
(NASA-TM-80557) Avail: NTIS HC A02/MF A01 CSCL 05B

As a preliminary step to developing a technique to eliminate the topographic effect from remotely sensed data, two radiance simulation models were examined and compared. A Lambertian and a non-Lambertian model were tested using hand-held radiometer measurements from a uniform surface at different slope angle aspect orientations. Linear correlation coefficients for the non-Lambertian model and the field spectra were calculated to be greater than 0.92 for all cases; whereas correlation coefficients for the Lambertian model ranged from 0.06 to 0.98. An assumption regarding an empirical constant within the non-Lambertian equation was found to be invalid and the model was improved by using subsets of the data to derive the empirical value.
Author

**N80-12534*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**INTERIM CALIBRATION REPORT FOR THE SMMR SIMULATOR**

P. Gloersen and D. Cavalieri (Systems and Applied Sciences Corp., Riverdale, Md.) Sep. 1979 22 p refs
(NASA-TM-80564) Avail: NTIS HC A02/MF A01 CSCL 14B

The calibration data obtained during the fall 1978 Nimbus-G underflight mission with the scanning multichannel microwave radiometer (SMMR) simulator on board the NASA CV-990 aircraft were analyzed and an interim calibration algorithm was developed. Data selected for the analysis consisted of in flight sky, first-year sea ice, and open water observations, as well as ground based observations of fixed targets with varied temperatures of selected instrument components. For most of the SMMR channels, a good fit to the selected data set was obtained with the algorithm.
K.L.

**N80-13908#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.

**THE GEOSCIENTIFIC AIRBORNE REMOTE SENSING PROGRAM Final Report**

Manfred Wahl Bonn Bundesmin. fuer Forsch. u. Technology Sep. 1978 233 p refs In GERMAN; ENGLISH summary
Original contains color illustrations
(Contract BMFT-WE-0175)
(BMFT-FB-W-78-31) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 48,75

The Airborne Remote Sensing program, carried out from 1974 to 1977 in the Federal Republic of Germany, is part of an international operational system of earth observation satellites. Within five selected test areas, numerous flights were performed using different multispectral sensors. The data were systematically evaluated using advanced image processing procedures. The extensive results verify the significant contribution of remote sensing to the solution of application-oriented problems, such as environmental monitoring, and justify the continuation of this space program.
Author (ESA)

# 08 INSTRUMENTATION AND SENSORS

**N80-13610#** Centre National d'Etudes Spatiales, Paris (France). Direction des Programmes et de la Politique Industrielle.
**SPOT, FRENCH PREOPERATIONAL REMOTE SENSING SATELLITE SYSTEM**
Alan A. Scribot 1978 15 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979
Avail: NTIS HC A02/MF A01

The SPOT remote sensing satellite system is described, including mission objectives, choice of orbit parameters for the first SPOT mission, the SPOT system architecture, the payload and choice of sensor parameters, the standard platform, and the ground segment. The payload consists of two high resolution visible sensors scanning 60 km each with 20 m resolution in several bands and 10 m resolution in the 0.5 to 0.9 micron (panchromatic) band. SPOT is suited for vegetation and water studies, cartographic applications, and geology. Author (ESA)

**N80-14444#** European Space Agency, Paris (France). Directorate of Planning and Future Programmes.
**THE EARTHNET PROGRAMME**
L. Mareli *In its* Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 20-27

Avail: NTIS HC A09/MF A01

A European network for the acquisition, preprocessing, archiving, and distribution of remote sensing satellite data is decribed. Emphasis is placed on distribution of LANDSAT data and increased utilization of space derived remote sensing imagery. Establishment of a basic capacity to handle data from both American and European remote sensing satellites, to provide high standard products tailored to the needs of users, and to include second generation remote sensing missions such as LANDSAT-D, Seasat-B and C, space shuttle based remote sensing experiments, and planed European remote sensing missions for the first Spacelab flight is outlined. J.M.S.

**N80-14448#** European Space Operations Center, Darmstadt (West Germany). Meteosat Data Management Dept.
**METEOSAT AND REMOTE SENSING APPLICATION**
K. G. Lenhart *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 61-72

Avail: NTIS HC A09/MF A01

The main characteristics of Meteosat and its associated ground system are described. The spacecraft orbit and attitude, mission objectives, and radiometer capabilities and image processing on the ground are discussed along with near real time image dissemination and the data collection platform sub-system. Remote sensing applications of Meteosat data are surveyed. J.M.S.

**N80-15380*#** General Electric Co., Philadelphia, Pa. Space Sciences Lab.
**PRESSURE MODULATOR RADIOMETER (PMR) TESTS**
E. L. G. Odell, F. M. Cosmi, A. E. Kreft, G. W. Racette, T. J. Maresca, F. O. Pancoast, D. J. Rutecki, and W. C. Yager 25 Sep. 1979 81 p
(Contract NAS1-15044)
(NASA-CR-159175) Avail: NTIS HC A05/MF A01 CSCL 14B

The pressure modulator technique was evaluated for monitoring pollutant gases in the Earth's atmosphere of altitude levels corresponding to the mid and lower troposphere. Using an experimental set up and a 110 cm sample cell, pressure modulator output signals resulting from a range of gas concentrations in the sample cell were examined. Then a 20 cm sample cell was modified so that trace gas properties in the atmosphere could be simulated in the laboratory. These gas properties were measured using an infrared sensor. R.E.S.

**N80-15538*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**POSSIBLE METHODS FOR DISTINGUISHING ICEBERGS FROM SHIPS BY AERIAL REMOTE SENSING**
Walton L. Howes Dec. 1979 38 p refs
(NASA-TM-79310; E-266) Avail: NTIS HC A03/MF A01 CSCL 08L

The simplest methods for aerial remote sensing which are least affected by atmospheric opacities are summarized. Radar is preferred for targets off the flight path, and microwave radiometry for targets along the flight path. Radar methods are classified by ability to resolve targets. Techniques which do not require target resolution are preferred. Among these techniques, polarization methods appear most promising, specifically those which differentiate the expected relatively greater depolarization by icebergs from that by ships or which detect doubly-reversed circular polarization. R.C.T.

# 09

# GENERAL

Includes economic analysis.

**A80-14792** **Landsat applications in Georgia - A successful example of technology transfer between NASA and state government.** B. Q. Rado (Georgia, Dept. of Natural Resources, Atlanta, Ga.) and L. E. Jordan, III (Georgia Institute of Technology, Atlanta, Ga.). In: Space - The best is yet to come; Proceedings of the Sixteenth Space Congress, Cocoa Beach, Fla., April 25-27, 1979. Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1979, p. 6-8 to 6-14.

Following a formal request by the State of Georgia for technology transfer assistance, NASA agreed to a plan (the Regional Application Program) with the following two objectives: phase I, to determine the feasibility of using Landsat-derived landcover information for resource management applications using NASA's computers and programs, essentially cost-free to the state; and phase II, to transfer the NASA application technology and computer software to Georgia. Landcover classifications of interest, as determined by Georgia's Department of Natural Resources, included high- and low-density urban, bare ground, agricultural production lands row crops, pasture or grasslands, forested areas, production forests, marshes, and surface water. The accuracy attained in locating each type of landcover is discussed. Other considerations involved determining the best time of year for visually separating each type of landcover from the others, and choosing the graphic display format, including the number of colors it contains. J.P.B.

**A80-15771** **Remote sensing applications in developing countries.** Edited by W. G. Collins (Aston, University, Birmingham, England) and J. L. van Genderen (Fairey Surveys, Ltd., Maidenhead, Berks., England). Birmingham, England, University of Aston, 1978. 103 p.

Papers are presented on applications of remote sensing to the exploitation, management and monitoring of the resources of developing nations. Specific topics include the use of Landsat imagery for natural resources mapping in western Sudan, the use of remote sensing for transport planning and highway engineering in developing nations, a photointerpretation study of erosion in rural Lesotho, reconnaissance soil mapping in India using Landsat imagery, side-looking airborne radar, satellite imagery and aerial photography for a forest survey in the Amazon basin, digital analysis of radar imagery for vegetation detection in Nigeria and an assessment of LACIE and related crop inventory methodologies. A.L.W.

**A80-16394** # **The use of space - International cooperation in the area of space applications (Kosmos-zemle - Mezhdunarodnoe sotrudnichestvo v oblasti prikladnogo izpol'zovaniia kosmonavtiki).** A. D. Koval' and Iu. A. Tiurin. Moscow, Izdatel'stvo Znanie, 1979. 112 p. In Russian.

The book deals with the international aspects of space activity. The discussion is centered on the use of space for remote sensing of earth resources, for purposes of national economy, and for communications, navigation, geodetic, and meteorological applications. Attention is given to a new industrial discipline - the manufacture of products in space. The influence of space research on science and technology is reviewed. V.P.

**A80-17993** # **Constructing a network of earth resource satellites (O zadache postroeniia seti ISZ dlia issledovaniia prirodnykh resursov zemli).** V. S. Komstantinov, A. A. Lebedev, V. A. Strel'tsov, and M. M. Khrustalev. *Kosmicheskie Issledovaniia,* vol. 17, Nov.-Dec. 1979, p. 945-948. 6 refs. In Russian.

The problem is formulated of developing a system of earth resource satellites capable of providing answers to numerous economic questions. The system must consist of several autonomous subsystems, and is required to function under a variety of conditions. A method, based on an optimization theory for multipurpose systems, is proposed to solve the problem. V.P.

**N80-10537*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EDUCATOR'S GUIDE FOR MISSION TO EARTH: LANDSAT VIEWS THE WORLD**
Margaret A. Tindal 1978 56 p refs Original contains color illustrations
(NASA-SP-360) Avail: NTIS MF A01, SOD HC CSCL 08B

This teacher's guide is specifically designed to provide information and suggestions for using LANDSAT imagery to teach basic concepts in several content areas. Content areas include: (1) Earth science and geology; (2) environmental studies; (3) geography; and (4) social and urban studies. R.E.S.

**N80-10587#** Hawaii Ad Hoc Committee on Remote Sensing, Honolulu.
**LANDSAT PROJECT, STATE OF HAWAII: A PRELIMINARY REPORT**
Dec 1978 41 p
(PB-296712/3; NOAA-79050811) Avail: NTIS HC A03/MF A01 CSCL 13B

The past, present and potential future application of satellite remote sensing technology is examined as a possible means for meeting growing land use and environment-related information needs of the State of Hawaii. GRA

**N80-11530#** Committee on Science and Technology (U. S. House).
**EARTH RESOURCES DATA AND INFORMATION SERVICE**
Washington GPO 1979 222 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., No. 24, 2-3 May 1979
(GPO-49-530) Avail: Subcomm. on Space Sci. and Applications

The implementation of and an earth resources data and information service is discussed. Policy issues surrounding the remote sensing of earth resources are presented. The role of the government versus the role of the private sector, the needs of private industry, state and local governments, and the international community are examined in relation to the formation of the earth resources and data information service. A.W.H.

**N80-11533*#** Battelle Columbus Labs., Ohio.
**AN ECONOMIC ANALYSIS OF FIVE SELECTED LANDSAT ASSISTED INFORMATION SYSTEMS IN OREGON Final Report**
S. Solomon and K. M. Maher Oct. 1979 30 p refs
(Contract NASw-2800)
(NASA-CR-162434; BCL-OA-TFR-79-5) Avail: NTIS HC A03/MF A01 CSCL 05B

A comparative cost analysis was performed on five LANDSAT-based information systems. In all cases, the LANDSAT system

was found to have cost advantages over its alternative. The information sets generated by LANDSAT and the alternative method are not identical but are comparable in terms of satisfying the needs of the sponsor. The information obtained from the LANDSAT system in some cases is said to lack precision and detail. On the other hand, it was found to be superior in terms of providing information on areas that are inaccessible and unobtainable through conventional means. There is therefore a trade-off between precision and detail, and considerations of costs. The projects examined were concerned with locating irrigation circles in Morrow County; monitoring tansy ragwort infestation; inventoring old growth Douglas fir near Spotted Owl habitats; inventoring vegetation and resources in all state-owned lands; and determining and use for Columbia River water policies.
A.R.H.

**N80-11995#** Committee on Space Research (COSPAR), Berne (Switzerland).
**SPACE RESEARCH IN SWITZERLAND, 1978**
1979 22 p Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/Jun. 1979 Sponsored by Swiss Natl. Sci. Found.
Avail: NTIS HC A02/MF A01

Swiss space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include satellite geodesy, middle atmosphere studies, magnetosphere studies, solar wind composition, investigations on fine materials and rocks returned from the moon, solar physics, astronomic photometry, and earth resources studies.
Author (ESA)

**N80-12722#** National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
**REPORT TO THE CONGRESS ON COASTAL ZONE MANAGEMENT. TRANSITION QUARTER AND FISCAL YEAR 1977**
Jan. 1979 113 p
(PB-298537/2; NOAA-79061803) Avail: NTIS HC A06/MF A01 CSCL 13B

This report contains separate sections on: identification of the state programs approved during the preceding Federal fiscal year and a description of those programs; listing of the states participating and a description of the status of each state's program and its accomplishments during the preceding Federal fiscal year; itemization of the allocation of funds to the various coastal states and a breakdown of the major projects and areas; an identification of any state programs which have been reviewed and disapproved and which grants have been terminated and a statement for the reasons for such action; activities and projects which are not consistent with an approved state management program; and a summary of regulations issued by the Secretary or in effect during the preceding Federal fiscal year.
GRA

**N80-14165#** Centre National d'Etudes Spatiales, Toulouse (France).
**FRENCH SPACE PROGRAMS [PROGRAMME SPATIAL FRANCAIS. RAPPORT AU COSPAR]**
1979 154 p refs In FRENCH; ENGLISH summary Presented at 22d COSPAR Assembly, Bangalore, India, May - Jun. 1979 Prepared in cooperation with Comite Natl. Franc. de Rech. dans l'Espace, Paris
Avail: NTIS HC A08/MF A01

French activites during 1979 in space research and correlated programs are summarized. The work accomplished in the fields of astronomy, solar system, planet studies, interplanetary medium, ionosphere and magnetospheric physics, aeronomy, meteorology, earth resources, geodesy, life sciences, and material sciences are discussed.
Author (ESA)

**N80-14449#** European Space Agency, Paris (France).
**THE ESA REMOTE SENSING PROGRAM: PRESENT ACTIVITIES AND FUTURE PLANS**
J. Plevin and I. Pryke *In its* Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 74-87 refs Presented at ISP/IUERO Symp., Freiburg, July 1978

Avail: NTIS HC A09/MF A01

The activities of the European Space Agency (ESA) concerning access to and development of remote sensing facilities are reviewed. European regional needs and priorities are emphasized, but aid programs to developing countries are also envisaged. Preparation of remote sensing experiments for use in Spacelab is discussed. The development of a metric camera and the microwave remote sensing experiment scheduled for the First Spacelab Payload are cited as examples. The organization of the Earthnet Program is then covered and ESA studies relating to the definition of other remote sensing satellite systems are summarized.
Author (ESA)

**N80-14971*#** National Aeronautics and Space Administration, Washington, D. C.
**A REVIEW OF NASA INTERNATIONAL PROGRAMS**
1 Jan. 1979 112 p refs
(NASA-TM-80845) Avail: NTIS HC A06/MF A01 CSCL 05A

A synoptic overview of NASA's international activities to January 1979 is presented. The cooperating countries and international organizations are identified. Topics covered include (1) cooperative arrangements for ground-based, spaceborne, airborne, rocket-borne, and balloon-borne ventures, joint development, and aeronautical R & D; (2) reimbursable launchings; (3) tracking and data acquisition; and (4) personnel exchanges. International participation in NASA's Earth resources investigations is summarized in the appendix. A list of automatic picture transmission stations is included.
A.R.H.

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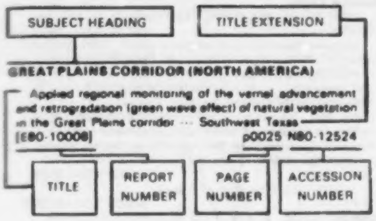
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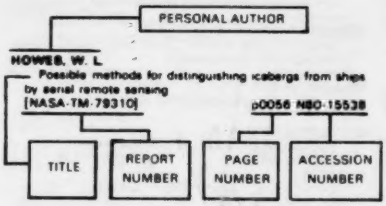

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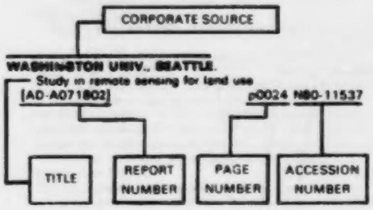

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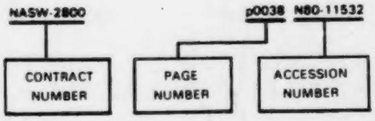

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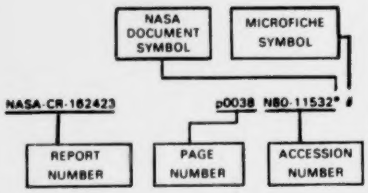

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This bibliography lists 380 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1980 and March 31, 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

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# EARTH RESOURCES

## A Continuing Bibliography
## With Indexes
## Issue 26

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1 and June 30, 1980 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

Scientific and Technical Information Branch 1980
**National Aeronautics and Space Administration**
Washington, DC

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# INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumention on orbiting spacecraft or on aircraft.

This literature survey lists 480 reports, articles, and other documents announced between April 1 and June 30, 1980 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

*IAA* entries identified by accession number series A80-10,000 in ascending accession number order;

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Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

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**05 OCEANOGRAPHY AND MARINE RESOURCES** **93**
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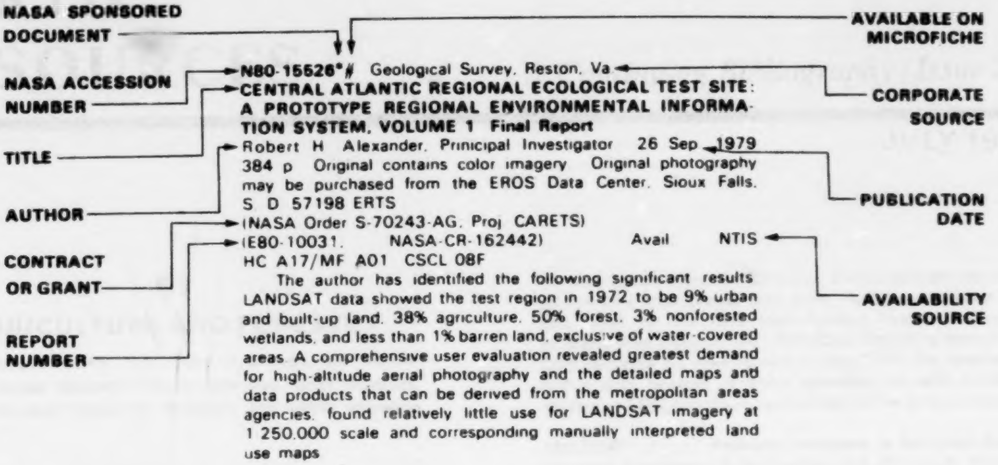
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**N80-15526*#** Geological Survey, Reston, Va
**CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report**
Robert H Alexander, Principal Investigator 26 Sep 1979 384 p Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D 57198 ERTS
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The author has identified the following significant results LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1 250,000 scale and corresponding manually interpreted land use maps

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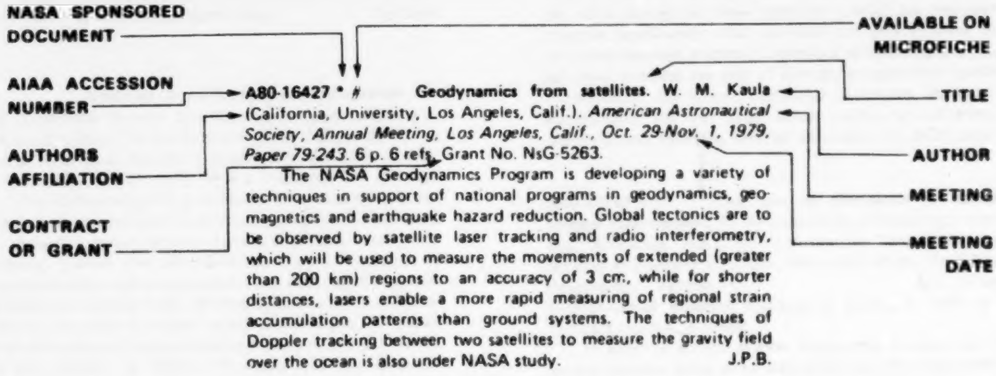
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**A80-16427 * #** **Geodynamics from satellites.** W. M. Kaula (California, University, Los Angeles, Calif.). *American Astronautical Society, Annual Meeting, Los Angeles, Calif., Oct. 29-Nov. 1, 1979, Paper 79-243.* 6 p. 6 refs. Grant No. NsG-5263.

The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geomagnetics and earthquake hazard reduction. Global tectonics are to be observed by satellite laser tracking and radio interferometry, which will be used to measure the movements of extended (greater than 200 km) regions to an accuracy of 3 cm, while for shorter distances, lasers enable a more rapid measuring of regional strain accumulation patterns than ground systems. The techniques of Doppler tracking between two satellites to measure the gravity field over the ocean is also under NASA study. J.P.B.

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# EARTH RESOURCES

## A Continuing Bibliography (Issue 26)

JULY 1980

## 01

## AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns

**A80-21446** **Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes.** M. K. Smit (Delft, Technische Hogeschool, Delft, Netherlands). *IEEE Transactions on Geoscience Electronics*, vol. GE-17, Oct. 1979, p. 303-308. 11 refs.

Preliminary results are reported of an investigation into the potential application of SLR images (that is, both SAR and SLAR images) for crop-inventory purposes employing temporal dependency to obtain multi-dimensional observations. To evaluate this potential, SLR-image data are simulated and subsequently classified. The results, which are restricted to VV-polarized X-band data, 'taken' at a typical SLAR angle of 20 deg (grazing), indicate that an overall average error fraction of less than 20% can be reached for the region involved, with less than 5% error for some crops. (Author)

**A80-21896** **Advances in earth resources management.** R. E. Tokerud (Lockheed Remote Sensing Applications Laboratory, Plainfield, N.J.). *Lockheed Horizons*, Winter 1979-1980, p. 32-36.

The Large Area Crop Inventory Experiment (LACIE), a joint program under NASA, USDA and NOAA is discussed. The aim was to find out if the technologies being developed in remote sensing and weather monitoring can be used to estimate agricultural crops on a global basis through Landsat pictures. Landsat's primary instrument is a multispectral scanner that simultaneously observes the earth in four parts of the electromagnetic spectrum. The data are telemetered to earth, and either converted into photographs or used in a digital computer format for spectral pattern recognition analysis. The paper gives an account of the exploratory studies made over the U.S. Great Plains and the U.S.S.R. in 1977 and shows that the obtained estimates proved to be quite accurate. L.M.

**A80-22386** # **Precision of crop-area estimates.** G. A. Hanuschak (U.S. Department of Agriculture, Statistical Research Div., Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 117-125. 6 refs.

Precision and controlled accuracy are the major criteria used by ESCS for evaluating crop-area estimates. Regression estimates which use both Landsat data and ESCS June Enumerative Survey data were substantially more precise than direct expansion estimates (ground data only) for the 1978 Iowa Landsat Project. The regression estimates were input to the USDA Crop Reporting Board's Annual Crop Summary for Iowa released January 1979. The repeatability of such efforts, however, is highly dependent on rapid Landsat data delivery to ESCS and cloud-free coverage of the analysis areas. B.J.

**A80-22387** * # **Accuracy assessment in the Large Area Crop Inventory Experiment.** A. G. Houston, D. E. Pitts, A. H. Feiveson, G. Badhwar, M. Ferguson (NASA, Johnson Space Center, Houston, Tex.), E. Hsu, J. Potter, R. Chhikara, M. Rader, and C. Ahlers (Lockheed Electronics Co., Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 127-146. 19 refs.

The Accuracy Assessment System (AAS) of the Large Area Crop Inventory Experiment (LACIE) was responsible for determining the accuracy and reliability of LACIE estimates of wheat production, area, and yield, made at regular intervals throughout the crop season, and for investigating the various LACIE error sources, quantifying these errors, and relating them to their causes. Some results of using the AAS during the three years of LACIE are reviewed. As the program culminated, AAS was able not only to meet the goal of obtaining accurate statistical estimates of sampling and classification accuracy, but also the goal of evaluating component labeling errors. Furthermore, the ground-truth data processing matured from collecting data for one crop (small grains) to collecting, quality-checking, and archiving data for all crops in a LACIE small segment. B.J.

**A80-22388** * # **The role of phenology in statistical crop acreage measurement.** P. A. Castruccio (ECOsystems International, Inc., Gambrills, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 147-165. Contract No. NAS8-32408.

In order to achieve market acceptance, the accuracy of remote sensing systems needs to be increased from the historically achieved average level of approximately 80-85% to 96-98%, i.e., by a factor of at least three, preferably five. A theory of discrimination is developed based on the fine-grained spectral data from LACIE supersites. It is shown that significant improvements in discrimination accuracy are possible by exploiting the differentials of crop spectra occurring between different phenologic stages. The major effects of such techniques on data system design are examined with respect to recurrence frequency, data volume, and information extraction. B.J.

**A80-22389** # **A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing.** W. G. Rohde, W. A. Miller, K. G. Bonner, E. Hertz, and M. F. Engel

(Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S. Dak.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 167-179. 15 refs. U.S. Geological Survey Contract No. 14-08-001-06439.

Landsat digital data and large-scale aerial photographs were used in a stratified-cluster sampling procedure to estimate the area of wildland vegetation cover types in northwestern Arizona. The Landsat data were used to stratify the project area into relatively homogeneous strata, partition each stratum into sample units, summarize estimates within each sample unit, and select and locate sample units for more precise measurement on large-scale aerial photographs. Aerial photographs at a 1:6000 scale were used to estimate the area of each vegetation cover type within the selected sample units. The results suggest that Landsat data and large-scale aerial photographs can be effectively used to inventory wildland vegetation. B.J.

**A80-22405** # **State of the art and needs of the earth platform.** L. B. Kuechle, D. P. DeMaster, and D. B. Siniff (Minnesota, University, Minneapolis, Minn.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 505-518. 10 refs.

It is noted that while there is interest in satellite tracking by biologists, especially in cases where animals are inaccessible using ordinary location and tracking techniques, little has been done in actual application of satellite tracking, due to the high cost of satellite packages and their excess size and weight. The paper surveys the current state of the art in designing the animal platform segment for use in satellite location systems. Discussion also covers areas where compromises may be possible allowing use in a wider range of applications. Finally, problems with batteries, antenna design and osciliator stability are discussed. M.E.P.

**A80-22412** # **Estimated winter wheat yields from Landsat MSS using spectral techniques.** T. W. Brakke and E. T. Kanemasu (Kansas State University of Agriculture and Applied Science, Manhattan, Kan.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 629-641. 11 refs.

An evapotranspiration (ET) model developed for winter wheat in Kansas was used with Landsat-based estimates of leaf area index to predict yields in Kansas, Texas, Idaho, and Washington. Yield equations were based on (1) the daily transpiration to potential evapotranspiration ratio (ET yield model) and (2) the partitioning of photosynthates between the reproductive and vegetative parts of the plant through the use of a partitioning function (photo model). Two different partitioning functions were evaluated. Correlation coefficients were 0.81 and 0.68 for the photo models and 0.72 for the ET yield model. (Author)

**A80-22413** * # **The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE.** R. G. Stuff and T. L. Barnett (NASA, Johnson Space Center, Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 645-657. 26 refs.

The object of the paper is to assess the results of the Large Area Crop Inventory Experiment (LACIE) and closely related research on yield estimation techniques based on remote sensing variables. The exploratory research conducted during LACIE substantiated the hypothesis of yield related information contained in Landsat multispectral scanner data and indicated some of its empirical characteristics. It is noted that leaf area and possibly other foliage features can be derived from spectral data for yield estimation through agrometeorological models and that multiple vegetative and grain related features may be discernable by Landsat derived wheat spectra at different points in the crop development. V.T.

**A80-22414** * # **Determination of range biomass using Landsat.** J. C. Harlan, R. H. Haas, W. E. Boyd (Texas A & M University, College Station, Tex.), and D. W. Deering (NASA, Goddard Space Flight Center, Greenbelt, Md.; Texas A & M University, College Station, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 659-673. 18 refs. NASA-supported research.

With the successful launch of Landsat-1 a series of rangeland investigations was begun by Texas A & M University. This series has been continuous and has evolved from the initial research phase of examining what Landsat could do into the present stage of evaluating the transfer of information and technology to the agri-business community. The discussion presented here consists of three parts: a brief history of rangeland Landsat work; present research efforts and results; and the present information transfer investigation. (Author)

**A80-22415** # **Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables.** C. H. Tom and L. D. Miller (Texas A & M University, College Station, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 675-692. 12 refs.

**A80-22423** # **Forest statistics by ARIES classification of Landsat multispectral images in northern Canada.** Z. D. Kalensky (Université Laval, Quebec, Canada), W. C. Moore, G. A. Campbell, D. A. Wilson (Petawawa National Forestry Institute, Chalk River, Ontario, Canada), and A. J. Scott (DIPIX Systems, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 789-811. 21 refs.

The usefulness of Landsat multispectral images for forest classification in the northern transitional forest zone is examined. An effective procedure for operational use is proposed, and its cost, time, and manpower requirements are assessed. V.P.

**A80-22424** # **Radar discrimination of crops.** S. Parashar, D. Day, J. Ryan, D. Strong, R. Worsfold (Remotec Applications, Inc., St. John's, Newfoundland, Canada), and G. King (Department of Agriculture, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 813-823. 19 refs.

An analysis of crop imagery is presented with the consideration of available ground truth information in the form of row spacing and direction, plant density and moisture, soil type and moisture, and growth state and cover. The ability of each channel to image various crops is discussed in terms of radar sensitivity to plant and soil parameters and conditions; the information available from combining data from the four channels is greater than that provided by an individual channel, but the utility of each channel in crop discrimination should be based on the results of digital analysis. A.T.

**A80-22437** # **An evaluation of Landsat-D for Canadian applications.** A. K. McQuillan and W. M. Strome (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 957-964.

A Landsat-D workshop was held to evaluate the capabilities of this satellite in meeting user requirements, and to address questions related to the design of the system to be developed to make data available to Canadian users. A wide range of applications were addressed, including potential benefits of Landsat data for forest inventory and protection, global wheat production forecasting, farm management, rangeland monitoring, streamflow forecasting, water quality studies, petroleum and mineral exploration, sea ice monitoring, and mapping activities. (Author)

**A80-22438** # **Temporal study on Paddy /rice/ using X-band scatterometer.** O. P. N. Calla, N. S. Pillai, O. P. Kaushik, and S. Sivaprasad (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 965-970.

With a view to explore and establish the possibilities of using active Microwave Sensors for operational spaceborne crop monitoring applications and to find the appropriate system parameters, a temporal study has been carried out on Paddy, one of the prime crops of India, using an X-band ground based scatterometer. This paper presents the results of this preliminary study. The results indicate that there is a significant change in scattering coefficient during the harvest period. (Author)

**A80-22439** * # **Small forest cuttings mapped with Landsat digital data.** E. Bryant (NASA, Goddard Institute for Space Studies, New York, N.Y.; Dartmouth College, Hanover, N.H.), A. G. Dodge (New Hampshire, University, Durham, N.H.), and M. J. E. Eger (Dartmouth College, Hanover, N.H.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 971-981. 5 refs.

The Cooperative Landsat Applications Research Group used computer classification of Landsat digital data to map forest cuttings (clearcuts) in northern New Hampshire. Cuttings as small as 3 hectares were identified. Several ages or conditions of clearcuts could be distinguished. Progress in two methods of duplicating classification categories from one Landsat pass to another are discussed. One method was used in making maps of areas in 1973, 1975, and 1978. (Author)

**A80-22450** * # **Remote sensing as a source of land cover information utilized in the universal soil loss equation.** D. R. Morris-Jones, K. M. Morgan, R. W. Kiefer, and F. L. Scarpace (Wisconsin, University, Madison, Wis.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1107-1115. U.S. Environmental Protection Agency Grant No. G-005139-01; Grant No. NGL-50-002-127.

In this study, methods for gathering the land use/land cover information required by the USLE were investigated with medium altitude, multi-date color and color infrared 70-mm positive transparencies using human and computer-based interpretation techniques. Successful results, which compare favorably with traditional field study methods, were obtained within the test site watershed with airphoto data sources and human airphoto interpretation techniques. Computer-based interpretation techniques were not capable of identifying soil conservation practices but were successful to varying degrees in gathering other types of desired land use/land cover information. (Author)

**A80-22453** * # **An evaluation of several different classification schemes - Their parameters and performance.** D. Scholz, N. Fuhs, and M. Hixson (Purdue University, West Lafayette, Ind.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1143-1149. 8 refs. Contract No. NAS9-15466.

The overall objective of this study was to apply and evaluate several of the currently available classification schemes for crop identification. The approaches examined were: (1) a per point Gaussian maximum likelihood classifier, (2) a per point sum of normal densities classifier, (3) a per point linear classifier, (4) a per point Gaussian maximum likelihood decision tree classifier, and (5) a texture sensitive per field Gaussian maximum likelihood classifier. Three agricultural data sets were used in the study: areas from Fayette County, Illinois, and Pottawattamie and Shelby Counties in Iowa. The segments were located in two distinct regions of the Corn Belt to sample variability in soils, climate, and agricultural practices. (Author)

**A80-22456** # **Estimation of primary production of vegetation in agricultural and forested areas using Landsat data.** Y. Mukai and S. Takeuchi (Remote Sensing Technology Center of Japan, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1177-1188. 5 refs.

A method to estimate the vegetal primary production from Landsat data is shown. Since vegetal resources are grouped into two categories, agricultural and forested one, a test area for each category was selected. Multitemporal Landsat scenes covering test areas with some ground truth data were obtained. For the agricultural test area, paddyfield area data and the dry biomass data related to each growth stage were collected; for the forest test area, area data of each forest type and timber volume data were collected. Crop classification or forest type classification was performed for the respective test area using multi-temporal Landsat images, and the results of the classification were compared with corresponding ground truth data. (Author)

**A80-22473** # **Forest inventory of clearcuts utilizing remote sensing techniques.** D. L. Hawley (EG & G, Inc., Las Vegas, Nev.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1385-1407.

The feasibility of utilizing Landsat MSS data in assessing surface cover types and areal extent of clearcut and shelterwood cut harvest sites in southern Oregon was investigated. The usefulness of various scales of panchromatic natural color and color infrared vertical aerial photography was evaluated for cover type mapping of clearcuts and shelterwood cuts. The photographic data were used in support of computer processing of Landsat. The research suggests that the application of Landsat MSS data in assessing cover types within clearcuts is limited but possible when appropriate ground truth information and computer processing are utilized. C.F.W.

**A80-22474** # **Sampling techniques to monitor forest area change.** G. S. Smith (Michigan, University, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1409-1418. 11 refs.

The effectiveness of three sampling methods, with varying sampling unit sizes and number of sampling units, in the establishment of a national, continental, or global monitoring program to follow the ever-changing acreages of forest area is evaluated. Ratio estimation calculations for the second stage of this design appear to be the most desirable for inclusion in the overall project. By increasing sampling unit size, number of sampling units, or a combination of the two, acceptable forest area results can be obtained. V.P.

**A80-22485** # **Mapping New Zealand's moisture rich soils from Landsat.** I. L. Thomas (Department of Scientific and Industrial Research, Physics and Engineering Laboratory, Lower Hutt, New Zealand). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1531-1540. 8 refs.

**A80-22486** * # **Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data.** A. H. Strahler, C. E. Woodcock (California, University, Santa Barbara, Calif.), and T. L. Logan (California Institute of Technology, Jet Propulsion Laboratory; Informatics, Inc., Pasadena, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1541-1557. 10 refs.

Accurate timber inventory data for cost-effective forest management is the primary goal of a Forest Classification and Inventory System (FOCIS) designed to provide estimates of timber volume by species aggregated by compartments, townships, or other spatial management units. FOCIS uses Landsat spectral data, including a synthesized texture channel, and Forest Service ground sample data to produce timber volume-homogeneous classes through a two-step unsupervised clustering process. Registered digital terrain data, including derived slope angle and slope aspect channels, are used to predict species proportions through a trend surface model, again using ground sample data for model calibration. In the final stage of FOCIS, volume estimates and predicted species proportions are merged and aggregated to yield timber volumes by species within management areas. (Author)

**A80-22487** # **Agricultural and resource assessment in Jamaica using an area sampling frame.** H. F. Huddleston (U.S. Department of Agriculture, Washington, D.C.) and R. Russell (Jamaican Ministry of Agriculture, Kingston, Jamaica). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1559-1566. 5 refs.

The paper presents a technology for using remote sensing in implementing an information system in a country with limited resources and known agricultural data needs. Specifically, Landsat imagery and infrared photography are obtained along with conventional topographic maps to develop an area sampling frame to inventory crop acreages, production and related agricultural information. (Author)

**A80-22497** # **Forest stand classification in western Washington using Landsat and computer-based resource data.** G. R. Johnson, E. W. Barthmaier (Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S. Dak.), T. W. D. Gregg, and R. E. Aulds (Washington Department of Natural Resources, Olympia, Wash.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1681-1696. 6 refs. U.S. Geological Survey Contract No. 14-08-0001-16439.

A study to determine if forest stand classification obtained from the analysis of digital Landsat data might be able to supplement present methods of acquiring forest resource information in Washington state is presented. Landsat data were clustered, and geometrically corrected and aligned with conventionally obtained forest stand data. Landsat classifications (composed of clear-cut, established plantations, and older forest classes) agreed with resource data in 87% of the independent samples of resource plots, and in 56% of the plots for discrete age and stocking classes. J.P.B.

**A80-22500** # **Area estimates by Landsat - Kansas 1976 winter wheat.** M. W. Craig, R. S. Sigman, and M. Cárdenas (U.S. Department of Agriculture, Statistical Research Div., Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1727-1736.

This paper describes research on the estimation of area planted to winter wheat in Kansas. Landsat multispectral scanner data were used as the auxiliary variable and ground survey data as the primary variable in a regression estimator. The main goal of the project was to improve the ground survey estimation procedures at state, multi-county, and individual county levels. Achievement of the goal was measured by the reduction in variance of the planted-area estimate computed using Landsat and ground data in comparison with the estimate computed using only ground data. The use of Landsat reduced the variation for the multi-county areas by 68 to 92 percent. Several new concepts aided this project in achieving its goals. The major new concept used was the combined regression, a statistical technique allowing estimation of certain parameters in areas that normally would not have enough samples, along with 'masked' classification and pseudo-counties. (Author)

**A80-22501** # **Assessment of mangrove forest deterioration in Zamboange Peninsula, Philippines using Landsat MSS data.** E. N. Lorenzo, B. R. de Jesus, Jr., and R. S. Jara (Ministry of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1737-1745.

**A80-22502** * # **Temporal resolution for crop discrimination estimated using J-M distance.** J. W. Baran, J. C. Conrad, Jr. (General Electric Co., Space Div., Philadelphia, Pa.), and D. B. Wood (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1747-1756. Contract No. NAS5-23412.

A study is presented which examines techniques utilizing spectral/phenological data to classify and mensurate target crops at predetermined accuracies in order to estimate the temporal resolution requirements for a remote sensing system. An analysis is made of the physical target (crop) characteristics as they vary in time. A model is developed relating the frequency required to attain a particular probability of correct discrimination with N accumulated observations to that required with single observations. Finally, results for a multicrop spectral data set are shown to substantiate the theoretically-modeled results. M.E.P.

**A80-22505** * # **Possible future directions in crop yield forecasting.** J. E. Colwell (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1781-1788. 10 refs. Contract No. NAS9-15476.

This paper examines present and future possible applications of remote sensing to crop yield forecasting. It is concluded that there are ways in which Landsat data could be used to assist in crop yield forecasting using present technology. A framework for global crop yield forecasting which uses remote sensing, meteorological, field and ancillary data, as available, is proposed for the future. (Author)

**A80-23294** **Coniferous tree species mapping using Landsat data.** S. J. Walsh (Oklahoma State University, Stillwater, Okla.). *Remote Sensing of Environment*, vol. 9, Feb. 1980, p. 11-26. 22 refs.

The paper deals with the application of Landsat digital data to the identification and mapping of 12 surface-cover types, including seven classes of coniferous tree species. The cover-types were mapped with an average accuracy of 88.8%, as compared with detailed ground truth. The combined effect of a quantity and quality of ground truth, the use of the controlled clustering classification technique, and the prudent placement of ISA (Intensive Study Areas) on the image-processing CRT screen for training static collection provided very subtle spectral reflectance differences among the coniferous tree species. V.P.

**A80-23295** **Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures.** G. J. R. Soer (Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques, Delft; Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands). *Remote Sensing of Environment,* vol. 9, Feb. 1980, p. 27-45. 25 refs.

**A80-23296** **Wombats detected from space.** E. Löffler and C. Margules (Commonwealth Scientific and Industrial Research Organization, Div. of Land Use Research, Canberra, Australia). *Remote Sensing of Environment,* vol. 9, Feb. 1980, p. 47-56. 13 refs.

The hairy-nosed wombat is a large marsupial that occurs in great numbers on the Nullarbor Plain, South Australia. Because of the animal's burrowing and mound building, which creates areas of bare ground and freshly dug soil, its approximate distribution can be mapped from digitally enhanced color Landsat imagery, and even to some degree from good quality band-7 black-and-white imagery. The feasibility of monitoring the spread of wombats by satellite imagery to provide farm and grazing land protection is discussed. V.P.

**A80-23299** **Estimation of grain yields by remote sensing of crop senescence rates.** S. B. Idso, P. J. Pinter, Jr., R. D. Jackson, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Remote Sensing of Environment,* vol. 9, Feb. 1980, p. 87-91. 10 refs.

A promising approach to crop yield estimation is that of crop reflectance assessment, using the system of Landsat satellites. In the present paper, a technique relying solely on Landsat data is developed on the basis of the concept of ageing or senescence. The technique may prove to be effective if satellite-derived spectral reflectances become available on a more frequent basis than is presently the case. V.P.

**A80-24052** **Remote sensing and soils - An application (La télédétection et les sols - Une mise au point).** F. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 3-14. 11 refs. In French.

The application of remote sensing techniques to the identification of soils and the monitoring of changes in rapidly varying soil properties (moisture content, air content, and temperature) is discussed. The principle methods of soil identification and mapping using the spectral characteristics of reflected radiation in the visible and near-infrared ranges are considered, taking into account measurements of soil texture, structure, and mineral content. Methods for characterizing the dynamic thermal and hydrological properties of soils are then examined, with attention given to the determination of soil moisture and temperature by means of passive and active (radar) microwave equipment, and determinations of soil temperature and thermal inertia in the thermal infrared and by the Heat Capacity Mapping Mission. It is concluded that although the remote sensing of soils is still in its initial stages, developments in sensing methods are expected to be quite useful, especially in the area of moisture determination. A.L.W.

**A80-24053** **Remote sensing applied to soils (La télédétection appliquée aux sols).** J. Cihlar (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 15-27. 47 refs. In French.

The use of remote sensing techniques for soil mapping and the evaluation of soil properties is reviewed. Consideration is given to the nature of remote sensing data, and applications of remote sensing techniques from black-and-white aerial photographs to Landsat to the mapping of soil units and the determination of the soil properties organic matter content, salinity, erosion and moisture content are presented. Future prospects for the remote sensing of soils are discussed, and it is concluded that the application of remote sensing techniques to soil management, as well as the research and development of new methods, will continue to expand. A.L.W.

**A80-24055** **Remote sensing studies of vegetation (Etudes de la végétation par télédétection).** L. S. Wittgenstein (Department of the Environment, Forest Management Institute, Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 45-52. 17 refs. In French.

Applications of remote sensing to the study of the identity, distribution, size, number, physical state, and health vegetation are discussed. Remote sensing has been used for forest inventories; the estimation of the biomass contained in forests and prairies; studies of animal habitats; forest fire localization; the detection and mapping of insect damage; disease and pollution damage to vegetation; flood, wind, and landslide damage determinations; the mapping of regions of forest cutting; and environmental monitoring by means of aerial photography and satellite observations. It is concluded that the utilization of satellite information represents a great advance, but cannot replace aerial photography. Recommendations concerning the expansion of Landsat data interpretation, remote sensing for local forest management, the remote detection of principal insect damage, vegetation monitoring, and biomass evaluation are also presented. A.L.W.

**A80-24056** **Remote sensing and forestry in Quebec (La télédétection et la foresterie au Québec).** J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 53-57. In French.

The possible application of advanced techniques of remote sensing to forest inventories and insect damage evaluation in Quebec is discussed. The present use of conventional black-and-white moderate-scale (1:15,000 to 1:20,000) aerial photography for forest inventories and mapping is noted. The applicability of aerial color infrared photography to the evaluation of spruce budworm and gypsy moth damage to forests and of Landsat imagery and radar to forest mapping is considered. It is concluded that color infrared photographs contain more useful information than conventional black-and-white photography, even at a smaller scale, while Landsat data could be used for the mapping of large forest territories, for forest mapping after fires or large-scale cutting, and for the mapping of northern forests. A.L.W.

**A80-24063** **Vegetation mapping in the Caniapiscau-Koksoak corridor using the automatic classification of Landsat images (Cartographie de la végétation du corridor Caniapiscau-Koksoak par classification automatique des images Landsat).** P. Laframboise and J.-M. Levasseur (Société de Développement de la Baie James, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 143-149. In French.

**A80-24064** **Radiometric correction of topographic effects on Landsat images of forest lands (Correction radiométrique des effets topographiques sur des images Landsat de territoires forestiers).** G. Rochon, H. Audirac, A. Larrivée (Université Laval, Quebec, Canada), J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada), and P. Gignac (Ministère des Terres et Forêts, Service de la Recherche, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 151-163. In

French. Research supported by the Université Laval, Natural Sciences and Engineering Research Council, and Ministère de l'Education du Québec.

The classification of Landsat data often experiences the combined effect of topography, angles of view from the satellite, and the solar illumination angles. In order to study the relationships between these factors, contour lines of a topographic map at a scale of 1:50,000 were digitized over various areas of forest lands in Quebec contained in a Landsat image. Balsam fir, black spruce, and white birch were the dominant species. For each pixel, the equation in polar coordinates of the normal to the terrain was computed and used to deduce the angles between the sun and the normal to each elementary plane and also between the satellite and the normal. B.J.

**A80-24065** **Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm (La photographie aérienne couleur infrarouge pour l'évaluation de la mortalité laissée par la tordeuse des bourgeons de l'épinette).** J. Beaubien and G. Simard (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbroore, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 165-168. In French.

**A80-24066** **The utilization of a stereotransferscope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000 (Utilisation d'un stéréotransferscope et de photographies à très petites échelles pour la mise à jour des cartes forestières à l'échelle de 1:20,000).** P. Gignac (Ministère des Terres et Forêts, Service de la Recherche, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 169-173. In French.

**A80-24067** **Utilization of a portable thermograph in the Ministère des Terres et Forêts (Utilisation d'un thermographe portatif au Ministère des Terres et Forêts).** B. Drolet (Ministère des Terres et Forêts, Service de la Protection Contre le Feu, Quebec, Canada) and H. Audet (Ministère des Terres et Forêts, Centre Québécois de Coordination de la Télédétection, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 175-179. In French.

Since 1978 the fire protection service of the Ministère des Terres et Forêts has been using a portable thermograph (the AGA Thermovision 750) for the final phase of certain forest fires. Used from an aircraft, the detector reveals, on the perimeter of a fire under control, areas that conceal latent centers of fire; the detector is thus a useful tool for the chief of operations in determining priorities. During the winter the thermograph is used for purposes of energy conservation. B.J.

**A80-24069** **Remote sensing and the agricultural zoning of lands (Télédétection et zonage agricole des terres).** H. Gagnon (Ottawa, University, Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada. May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 197-204. 5 refs. In French.

Various aspects of remote sensing applied to agricultural zoning are discussed. Attention is given to the following: (1) the correction of differences in maps of agricultural potential, (2) the detection of variations in the intensity of agricultural land use, (3) the analysis of modifications in the draining pattern, (4) the evaluation of the quality of constructions and environmental protection norms, (5) the analysis of conflicting zoning units, (6) the surveillance of maple groves, and (7) the measurement of the homogeneity of a zoning unit. The use of Landsat images, infrared color photography, and thermography is examined. B.J.

**A80-25569** # **Crop-area estimates from Landsat - Transition from research and development to timely results.** G. Hanuschak, R. Sigman, M. Craig, M. Ozga, R. Luebbe, P. Cook, D. Kleweno, and C. Miller (U.S. Department of Agriculture, Washington, D.C.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 86-96. 7 refs.

Recent efforts by the USDA in developing timely, precise crop-area estimates over Iowa from Landsat are described, and the relevant data processing systems hardware and software, as well as data management, are examined. Statistical methodology is considered, including direct expansion estimation using ground data only, and regression estimation which also uses computer classified Landsat data. It is found that the major benefit of Landsat regression estimates is substantial improvements in precision with no increase in the respondent burden associated with ground surveys. J.P.B.

**A80-25570** * **Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach.** M. M. Hixson, M. E. Bauer (Purdue University, West Lafayette, Ind.), and B. J. Davis (Indiana Bell Telephone Co., Indianapolis, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 97-104. 8 refs. Contract No. NAS9-14970.

The objective of this investigation was to evaluate the effect of sampling on the accuracy (precision and bias) of crop area estimates made from classifications of Landsat MSS data. Full-frame classifications of wheat and non-wheat for eighty counties in Kansas were repetitively sampled to simulate alternative sampling plans. Four sampling schemes involving different numbers of samples and different size sampling units were evaluated. The precision of the wheat area estimates increased as the segment size decreased and the number of segments was increased. Although the average bias associated with the various sampling schemes was not significantly different, the maximum absolute bias was directly related to sampling unit size. (Author)

**A80-25571** **Multi-temporal classification of winter wheat using a growth state model.** C. A. Hlavka, S. M. Carlyle (Kansas, University, Lawrence, Kan.), R. Yokoyama (Itawe University, Itawe, Japan), and R. M. Haralick (Virginia Polytechnic Institute and State University, Blacksburg, Va.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 105-115. 34 refs.

A multi-temporal classification procedure for crops in Landsat scenes is described. The method involves the creation of crop signatures which characterize multi-spectral observations as functions of phenological growth states. The phenological signature models spectral reflectance explicitly as a function of crop maturity rather than a function of observation date. Instead of stacking spectral vectors of one observation on another, as is usually done for multi-temporal data, for each possible crop category there is established a correspondence of time to growth state which minimizes the smallest difference between the given multi-spectral multi-temporal vector and the category mean vector indexed by growth state. The results of applying this procedure to winter wheat show that the method is capable of discrimination with about the same degree of accuracy as more traditional multi-temporal classifiers. It also has potential for labelling the degree of maturity of the crop without crop condition information in the training set. (Author)

**A80-25573 #** **Landsat-2 data for inventorying rangelands in south Texas.** J. H. Everitt, A. J. Richardson, A. H. Gerbermann, C. L. Wiegand, and M. A. Alaniz (U.S. Department of Agriculture, Weslaco, Tex.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 132-141. 17 refs.

The effectiveness of Landsat 2 multispectral scanner data in the inventory of rangelands and other land-use categories is investigated for a rangeland area in south Texas. MSS computer compatible tapes and corresponding color images from two Landsat 2 overpasses of the study area were used to identify wetlands, agricultural lands, barren lands, water, and the rangeland subcategories of grasslands, mixed brush rangelands, and live oak rangelands by a training-field classification approach. Computer-estimated land-use percentages are found to correlate significantly with photo-estimated percentages based on a ground-correlated Landsat color composite print for the Landsat overpass in October, but not for the December overpass due to the misclassification of mixed brush as grassland. It is concluded that Landsat 2 data can be used successfully to identify level I land use in both October and December, while level II rangeland land use categories could best be identified in October. A.L.W.

**A80-25576** **Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography.** W. D. McFarland, T. W. Barney, and C. J. Johannsen (Missouri-Columbia, University, Columbia, Mo.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 159-165.

**A80-25582 *** **Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences.** W. D. Rosenthal, J. C. Harlan, B. J. Blanchard (Texas A & M University, College Station, Tex.), and G. Coleman (U. S. Department of Agriculture, Chickasha, Okla.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 224-233. 5 refs. Contract No. NAS5-24383.

**A80-25583** **Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana.** C. E. Seubert, M. F. Baumgardner, R. A. Weismiller (Purdue University, West Lafayette, Ind.), and F. R. Kirschner (U.S. Department of Agriculture, Soil Conservation Service, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 234-239. 9 refs.

**A80-25584** **Extraction of soil information from a vegetated area.** M. Fukuhara, S. Hayashi (Hokkaido National Agricultural Experimental Station, Hokkaido, Japan), Y. Yasuda, I. Asanuma, Y. Emori (Chiba University, Chiba, Japan), and J. Iisaka (IBM Japan, Ltd., Tokyo Scientific Center, Tokyo, Japan). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 242-252. 7 refs.

In order to extract soil information from a vegetated area and to analyze soil conditions, a simple ratio transformation was derived which eliminates the influence of vegetation reflectance from soil reflectance. The usefulness of the transformation was investigated by multispectral pattern recognition. It is found that a combination of channels, namely Landsat 5, Landsat 7, the new transformation, and Landsat (7-5)/(7+5), gives the best results, since the soil classes and other vegetation classes are not distinguishable using only the transformation channel. J.P.B.

**A80-25585** **Extension of laboratory-measured soil spectra to field conditions.** E. R. Stoner, M. F. Baumgardner, R. A. Weismiller, L. L. Biehl, and B. F. Robinson (Purdue University, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 253-263. 23 refs.

A study was made to differentiate between two humid mesic region glaciated soils, Chalmers silty clay loam and Fincastle silt loam, on the basis of spectroradiometric response under varied field and laboratory conditions, and to verify the validity of laboratory-measured soil spectra for characterizing soil reflectance in the field. Results indicate that laboratory-measured spectra of moist soil are directly proportional to the spectral response of that same moist bare soil in the field over the 0.52 to 1.75 micron wavelength range. In addition, the magnitude of differences in spectral response between identically treated Chalmers and Fincastle soils is greatest in the 0.6 to 0.8 micron transition region between the visible and near infrared, regardless of field condition or laboratory preparation studied. J.P.B.

**A80-25586** **Predictability of change in soil reflectance on wetting.** J. B. Peterson, B. F. Robinson (Purdue University, West Lafayette, Ind.), and R. H. Beck (Illinois, University, Urbana, Ill.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 264-274. 14 refs.

**A80-25595 *** **Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California.** L. Fox, III and K. E. Mayer (Humboldt State University, Arcata, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 364-367. 8 refs. Grants No. NsG-2244; No. NsG-2341.

**A80-25596 *** **A forester's look at the application of image manipulation techniques to multitemporal Landsat data.** D. L. Williams (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.), M. L. Stauffer, and K. C. Leung (Computer Sciences Corp., Silver Spring, Md.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 368-376. 11 refs.

Registered, multitemporal Landsat data of a study area in central Pennsylvania were analyzed to detect and assess changes in the forest canopy resulting from insect defoliation. Images taken July 19, 1976, and June 27, 1977, were chosen specifically to represent forest canopy conditions before and after defoliation, respectively. Several image manipulation and data transformation techniques, developed primarily for estimating agricultural and rangeland standing green biomass, were applied to these data. The applicability of each technique for estimating the severity of forest canopy defoliation was then evaluated. All techniques tested had highly correlated results. In all cases, heavy defoliation was discriminated from healthy forest. Areas of moderate defoliation were confused with healthy forest on northwest (NW) aspects, but were distinct from healthy forest conditions on southeast (SE)-facing slopes. (Author)

**A80-25597 *** **Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping.** M. D. Fleming and R. M. Hoffer (Purdue University, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 377-390. 9 refs. Contract No. NAS9-14016.

A study with the objective of developing and testing techniques which utilize both digital topographic data and Landsat MSS spectral data to map forest cover types is examined. Emphasis is given to the topographic distribution model (TDM), which combines point-by-point information about forest species, elevation, slope, and aspect to quantitatively describe topographic positions. Results show the stratified random sample approach to be very effective for developing the TDM, while the use of topographic data significantly improved the overall classification accuracy of forest cover types as compared to using spectral data alone. J.P.B.

**A80-25598** **Texture analysis by space filter and application to foresttype classification.** J. Iisaka (IBM Japan, Ltd., Tokyo Scientific Center, Tokyo, Japan). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 392, 393.

**A80-25599** **Computer recognition of citrus infestations.** D. H. Williams (Texas, University, El Paso, Tex.) and J. K. Aggarwal (Texas, University, Austin, Tex.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 398-407. 17 refs.

A computer software system is described that uses digitized color information from aerial color infrared transparencies to detect the presence of citrus mealybug (Pseudococcus citri Risso), brown soft scale (Coccus hesperidum L.), and Rio Grande gummosis in individual citrus trees. The color coordinates at each spatial point, and color differences at adjacent points are used to locate the trees and to detect the infestations; compensation is made for the variation in color characteristics between different transparencies. The system requires the input of four parameters; a flag denoting the presence of heavy shadows in the image, nominal tree size and spacing of the citrus trees, and a flag denoting the season of the year when the transparency was taken. An index of recognition, Iq, was defined and used as a measure of recognition effectiveness. For unknown data, Iq ranged from 43% to 81%, with nominal values of 60% to 80% for all three infestations. (Author)

**A80-25600** **An interactive color display system for labelling crops.** T. Kaneko, L. K. Moore, and R. T. Smart (IBM Corp., Federal Systems Div., Houston, Tex.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 408-419. 14 refs.

The paper describes a computer based interactive display system for assisting photo-interpreters. The principle of the system is to reduce contact time and to increase labelling accuracy. Attention is given to the conversion of descriptive crop phenology on a crop calendar into quantitative growth index curves. It is demonstrated that this method offers an effective solution to alleviating problems associated with current manual labelling processes. C.F.W.

**A80-26086 * #** **LACIE - An application of meteorology for United States and foreign wheat assessment.** J. D. Hill (NASA, Johnson Space Center, Houston, Tex.; NOAA, Center for Environmental Assessment Service, Columbia, Mo.), N. D. Strommen, C. M. Sakamoto, and S. K. LeDuc (NOAA, Center for Environmental Assessment Service, Columbia, Mo.). *Journal of Applied Meteorology,* vol. 19, Jan. 1980, p. 22-34. 8 refs.

This paper describes the overall Large Area Crop Inventory Experiment technical approach utilizing the global weather-reporting network and the Landsat satellite to make a quasi-operational application of existing research results, and the accomplishments of this cooperative experiment in utilizing the weather information. Global weather data were utilized in preparing timely yield estimates for selected areas of the U.S. Great Plains, the U.S.S.R. and Canada. Additionally, wheat yield models were developed and pilot tested for Brazil, Australia, India and Argentina. The results of the work show that heading dates for wheat in North America can be predicted with an average absolute error of about 5 days for winter wheat and 4 days for spring wheat. Independent tests of wheat yield models over a 10-year period for the U.S. Great Plains produced a root-mean-square error of 1.12 quintals per hectare (q/ha) while similar tests in the U.S.S.R. produced an error of 1.31 q/ha. Research designed to improve the initial capability is described as is the rationale for further evolution of a capability to monitor global climate and assess its impact on world food supplies. (Author)

**A80-26312 #** **Crop identification in a parkland environment using aerial photography.** P. H. Crown (Alberta, University, Edmonton, Canada). *Canadian Journal of Remote Sensing,* vol. 5, Dec. 1979, p. 128-135. 5 refs. Research supported by the Alberta Hail and Crop Insurance Corp. and Alberta Environment.

The estimation of crop production using remote sensing techniques first requires a correct identification of the crops found in a given area. In Western Canada, the identification of field crops is hampered by the occurrence of confusion crops such as spring grains. These follow crop calendars and/or possess spectral signatures similar to each other. The results of an interpretation test using color and color infrared photography show a higher percent correct identification of spring grains with the color photography. This is attributed in part to the differences in visible colors often noted in the field during the vegetative period between darker green wheat crops and lighter green oat and barley crops. A higher percent correct identification of fallow fields was attained with the color infrared photography. Relatively high percent commission errors were made for grain and hay crops with both types of photography. (Author)

**A80-26313 *** **Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula.** H. C. Sweet, T. O. Peeples (Central Florida, University, Orlando, Fla.), J. E. Poppleton (Environmental Science and Engineering, Inc., Tampa, Fla.), and A. G. Shuey (Conservation Consultants, Palmetto, Fla.). *Remote Sensing of Environment,* vol. 9, Mar. 1980, p. 93-108. 6 refs. Grant No. NGR-10-122-006.

**A80-26315** **Assessment of the fertilizer requirement of improved pasture from remote sensing information.** P. J. Vickery, D. A. Hedges (Commonwealth Scientific and Industrial Research Organization, Pastoral Research Laboratory, Armidale, New South Wales, Australia), and M. J. Duggin (Commonwealth Scientific and Industrial Research Organization, Minerals Research Laboratory, Ryde, New South Wales, Australia; New York, State University, Syracuse, N.Y.). *Remote Sensing of Environment,* vol. 9, Mar. 1980, p. 131-148. 20 refs.

**A80-26318 *** **A spectral method for determining the percentage of green herbage material in clipped samples.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). *Remote Sensing of Environment,* vol. 9, Mar. 1980, p. 175-181. 10 refs.

A laboratory radiometric method for the rapid determination of green and brown vegetation percentages in clipped grass samples has been developed and tested. The method uses red and photographic infrared radiance or reflectance differences between green and brown vegetation. Mixtures of green and brown material were found to have radiances or reflectances proportional to the percentage of green material present. This method may permit the use of rapid green/brown radiometric determinations to replace the tedious hand sorting now generally used. It may also have application in remote sensing of vegetation ground-truth work where the determination of dry green biomass in clipped samples is necessary. (Author)

**A80-26752 #** **The NIRAD survey of forest resources - An application of SLAR in Nigeria.** J. A. Allan (London, University, London, England). *(Association of American Geographers, Remote Sensing Workshop, New Orleans, La., Mar. 9-12, 1978.) Remote Sensing Quarterly,* vol. 2, Jan. 1980, p. 36-44. 13 refs.

Resource studies in many tropical areas have been impeded by prevalent cloud cover and weather sensitive systems such as aerial photography and Landsat have yielded little useful information in such areas. The NIRAD (Nigerian radar survey of forest resources) survey was commissioned by the Nigerian Federal Department of Forestry to provide a national inventory of forest resources. The field checking carried out to date has shown the imagery to be effective in mapping ecological boundaries in the moist south of the country, but in the north Landsat images and the extensive air-photo cover have proved to be a richer source of vegetation and land use data. (Author)

**A80-27435 *** **Landsat-based multiphase estimation of California's irrigated lands.** S. L. Wall, R. W. Thomas (California, University, Berkeley, Calif.), and L. R. Tinney (California, University, Santa Barbara, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 221-236. 6 refs. Grant No. NsG-2207; Contract No. NAS5-20969.

Currently, inventory of California's irrigated lands is performed on a seven year cycle. Since 1975, the University of California in cooperation with NASA and the California Department of Water Resources has been developing and testing techniques to utilize a Landsat based remote sensing system to produce statewide estimates in a single year. The proposed system utilizes multiphase sampling, stratification and multitemporal Landsat imagery to produce the estimate. Early research concentrated on regional estimates to develop the techniques. This year, an inventory of the entire state of California is being performed. In addition, research on the utilization of digital analysis for estimating irrigated acreage and the determination of specific crop types (manual and digital analysis) is also underway. (Author)

**A80-27437** **Use of low altitude aerial biosensing with color infrared photography as a crop management service.** J. J. Baber, Jr. and A. D. Flowerday (OMAX Biosensing, Omaha, Neb.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 252-259.

**A80-27458 *** **Crop emergence date determination from spectral data.** G. D. Badhwar (NASA, Johnson Space Center, Houston, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Mar. 1980, p. 369-377. 7 refs.

Estimating the emergence of a given crop, such as wheat or barley, is proposed using an analytic method which relies on the hypothesis that in the region (lambda = 0.70-1.35 microns) a given crop, after emergence, has a unique spectral profile in time. If the crop emerges early or late, relative to a reference standard determined for a given segment, the profile is displaced but has the same shape. Therefore, given the crop specific constants of the reference profile and a sufficient number of Landsat observations of reflectivity at specific times, the emergence date of a field can be determined. J.P.B.

**A80-30921** **Landsat wildland mapping accuracy.** W. J. Todd, D. G. Gehring (Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.), and J. F. Haman (National Park Service, Denver, Colo.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Apr. 1980, p. 509-520. 8 refs. U.S. Geological Survey Contract No. 14-08-0001-16439.

A Landsat-aided classification of ten wildland resource classes was developed for the Shivwits Plateau region of the Lake Mead National Recreation Area. Single stage cluster sampling (without replacement) was used to verify the accuracy of each class. For verification, 63 plots were randomly selected throughout the classification image (gridded into 52 ha cells), located on 1:30,000 scale black-and-white aerial photographs, and gridded into nine 5.8 ha cells each. Resource specialists interpreted the 5.8 ha cells, field checked selected sites from light aircraft, and re-checked their photointerpretation. Construction of contingency tables revealed that there was less confusion between aggregated (more generalized) resources classes - grouped on the basis of soils, terrain, and vegetative cover similarities - than detailed resource categories. Parametric calculations of percentages correct and confidence intervals fully supported those findings. (Author)

**A80-32270 #** **Experience with the use of synthesized color images for the interpretation of agricultural objects (Opyt ispol'zovaniia tsvetnykh sintezirovannykh snimkov dlia deshifrirovaniia sel'skokhoziaistvennykh ob'ektov).** T. P. Butivshchenko and N. I. Lesnichaia. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 57-62. In Russian.

**A80-32280 #** **The use of multispectral photographs for soil cover studies (Vozmozhnosti ispol'zovaniia mnogozonal'nykh snimkov v issledovaniiakh pochvennogo pokrova).** V. I. Kravtsova and S. A. Nikolaeva. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 148-154. In Russian.

The paper examines the application of multispectral aerial or space photography to soil mapping; features of interpretation are discussed along with the suitability of multispectral photography for different soil types. The interpretation of Landsat photographs of the Danube River delta is considered as an example. B.J.

**A80-32281 #** **The use of microwave radiometry for the operational mapping of soil moisture (Primenenie metoda sverkhvysokochastotnoi radiometrii dlia operativnogo kartografirovaniia vlazhnosti pochv i gruntov).** A. E. Basharinov, I. M. Butenko, E. I. Reutov, and A. M. Shutko. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 154-159. 10 refs. In Russian.

**A80-32283 #** **Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs (Izuchenie sostoianiia posevov khlopchatnika i osobennostei pochvennogo pokrova po mnogozonal'nym aerofotosnimkam).** T. P. Butivshchenko, Iu. I. Kondratova, and I. A. Labutina. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 181-191. In Russian.

**A80-32284 #** **Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/ (Raspoznavanie sel'skokhoziaistvennykh kul'tur po raznovremennym kosmicheskim snimkam /Na primere izucheniia Nizhnego Povolzh'ia/).** I. E. Ponomareva, V. I. Kravtsova, and L. F. Ianvareva. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 191-215. In Russian.

**A80-32518 *** **Thermography for estimating near-surface soil moisture under developing crop canopies.** J. L. Heilman and D. G. Moore (South Dakota State University, Brookings, S. Dak.). *Journal of Applied Meteorology,* vol. 19, Mar. 1980, p. 324-328. 10 refs. Contract No. NAS5-24206.

Previous investigations of thermal infrared techniques using remote sensors (thermography) for estimating soil water content have been limited primarily to bare soil. Ground-based and aircraft investigations were conducted to evaluate the potential for extending the thermography approach to developing crop canopies. A significant exponential relationship was found between the volumetric soil water content in the 0-4 cm soil layer and the diurnal difference between surface soil temperature measured at 0230 and 1330 LST (satellite overpass times of NASA's Heat Capacity Mapping Mission - HCMM). Surface soil temperatures were estimated using minimum air temperature, percent cover of the canopy and remote measurements of canopy temperature. Results of the investigation demonstrated that thermography can potentially be used to estimate soil temperature and soil moisture throughout a complete growing season for a number of different crops and soils. (Author)

**N80-16391*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Annual Report, 16 Dec. 1978 - 15 Jan. 1979**
R. M. Hoffer, M. D. Fleming, L. A. Bartolucci, S. M. Davis, and R. F. Nelson, Principal Investigators 15 Jan. 1979 169 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15508)
(E80-10041; NASA-CR-160379; LARS-TR-011579) Avail: NTIS HC A08/MF A01 CSCL 08B

**N80-16393*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**COMPUTER-AIDED PROCESSING OF LANDSAT MSS DATA FOR CLASSIFICATION OF FORESTLANDS**
Ross F. Nelson and Roger M. Hoffer, Principal Investigators Oct. 1979 103 p refs ERTS
(Contract NAS9-15508)
(E80-10043; NASA-CR-160381; LARS-TR-102679) Avail: NTIS HC A06/MF A01 CSCL 02F

**N80-16394*#** Lockheed Electronics Co., Houston, Tex.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). THE BOUNDARY PIXEL STUDY IN KANSAS AND NORTH DAKOTA**
D. T. Register, Principal Investigator and A. L. Ona Sep. 1979 34 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10044; NASA-CR-160365; JSC-14563; LEC-12826) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. The statistical mapping approach to handling boundary pixels can be used as a standard for objectively comparing the cluster based technique, the maximum likelihood estimate based technique, and multicategory labeling.

**N80-16399*#** Lockheed Electronics Co., Houston, Tex.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). DETAILED DESCRIPTION OF THE WHEAT ACREAGE ESTIMATION PROCEDURE USED IN THE LARGE AREA CROP INVENTORY EXPERIMENT**
Willa W. Austin, Principal Investigator Feb. 1978 43 p refs Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15200)
(E80-10051; NASA-CR-160405; LEC-11497) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-16400*#** Lockheed Electronics Co., Houston, Tex.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PROFILE SIMILARITY FEASIBILITY STUDY**
Charles V. Nazare, Principal Investigator Oct. 1979 44 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10052; NASA-CR-160406; JSC-16246; LEC-14010) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-16404*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**L-BAND RADAR SENSING OF SOIL MOISTURE**
A. T. C. Chang, S. Atwater (California Univ., Santa Barbara), V. V. Salomonson, J. E. Estes (California Univ., Santa Barbara), D. S. Simonett (California Univ., Santa Barbara), and M. L. Bryan (JPL) Jan. 1980 32 p refs Submitted for publication
(NASA-TM-80628) Avail: NTIS HC A03/MF A01 CSCL 08M

The performance of an L-band, 25 cm wavelength imaging synthetic aperture radar was assessed for soil moisture determination, and the temporal variability of radar returns from a number of agricultural fields was studied. A series of three overflights was accomplished over an agriculutural test site in Kern County, California. Soil moisture samples were collected from bare fields at nine sites at depths of 0-2, 2-5, 5-15, and 15-30 cm. These gravimetric measurements were converted to percent of field capacity for correlation to the radar return signal. The initial signal film was optically correlated and scanned to produce image data numbers. These numbers were then converted to relative return power by linear interpolation of the noise power wedge which was introduced in 5 dB steps into the original signal film before and after each data run. Results of correlations between the relative return power and percent of field capacity (FC) demonstrate that the relative return power from this imaging radar system is responsive to the amount of soil moisture in bare fields. The signal returned from dry (15% FC) and wet (130% FC) fields where furrowing is parallel to the radar beam differs by about 10 dB. A.R.H.

**N80-16600#** Tennessee Valley Authority, Chattanooga. Office of Natural Resources.
**REMOTE SENSING OF SULFUR DIOXIDE EFFECTS ON VEGETATION - PHOTOMETRIC ANALYSIS OF AERIAL PHOTOGRAPHS**
C. Daniel Sapp Jun. 1979 42 p refs
(PB-300460/3; TVA/ONR-79/01; EPA-600/7-79-138) Avail: NTIS HC A03/MF A01 CSCL 13B

Spectral reflectances were measured by tri band densitometry of aerial color infrared photographs of soybean Glycine mass fields that had been affected by sulfur dioxide (SO2) emissions from large, coal fired power plants in northwestern Alabama and western Tennessee. The photographs were photometrically calibrated. Results indicate that, at very light levels of foliar injury, the infrared to red reflectance ration decreased with increasing injury. This behavior was in accordance with theory. At moderate and severe levels of injury, the ratio increased with injury. The best indicator of crop yield was green band reflectance, but the red and infrared bands were nearly as good. The yield variable actually increased with the level of injury, apparently because of field to field variations in canopy density. GRA

**N80-18500*** Oregon State Univ., Corvallis.
**AN INVESTIGATION OF THE UTILITY OF LANDSAT 2 MSS DATA TO THE FIRE-DANGER RATING AREA, AND FOREST FUEL ANALYSIS WITHIN CRATER LAKE NATIONAL PARK, OREGON Ph.D. Thesis**
Hassan Alizadeh Rabii 1979 434 p
Avail: Univ. Microfilms Order No. 8002679

Downed forest fuel tonnage/acre within Crater Lake National Park was inventoried and mapped using LANDSAT multispectral data in conjunction with National Cartographic Information Center (NCIC) digital topographic Information. Interactive classification capability of a Nova 840 computer system and its video color display provided identification and mapping criteria for classification of various surface and cover types within the park. Ground truth information was utilized to correlate the MSS/topographic data set to color IR aerial photographic data. Dissert. Abstr.

**N80-18505** Utah State Univ., Logan.
**FEATURE SELECTION AND CLASSIFIER DESIGN WITH APPLICATIONS TO REMOTE SENSING OF MULE DEER Ph.D. Thesis**
Manmohan M. Trivedi 1980 134 p
Avail: Univ. Microfilms Order No. 8005119

The deer detection problem where the classification is performed in a multidimensional feature space. A generalized scene, of which the winter range may be considered typical is used in the classification. It includes the deer, evergreen trees, sagebrush, and dry brush against a snow background. A general interclass feature selection procedure, based upon clustering technique, was formulated and used to select best feature sets for the analysis. The classification performance was estimated by considering the a priori probabilities of 'not-deer' objects sufficiently high to eliminate the misclassification of not-deer objects into deer class. The three or four feature classifier was shown to be capable of providing useful deer census data in an operational system when combined with appropriate spatial classification techniques. Dissert. Abstr.

**N80-18506*#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
**DEVELOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES Final Report, 15 Nov. 1978 - 14 Nov. 1979**
Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 217 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10054; NASA-CR-160421; ERIM-132400-29-1F; SR-E9-00404) Avail: NTIS HC A10/MF A01 CSCL 02C

**N80-18507*#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
**DEVLEOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES: APPENDICES Final Report, 15 Nov. 1978 - 14 Nov. 1979**
Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 303 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10055; NASA-CR-160422; ERIM-132400-29-2F; SR-E9-00404) Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-18509*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THREE-CATEGORY CLASSIFICATION**
K. A. Havens and K. M. Abotteen, Principal Investigators Aug. 1979 45 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10058; NASA-CR-160436; JSC-16012; LEC-13498)
Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following signficant results. Examination of both machine estimates and stratified areal estimates produced by clustering and classification reveal no significant differences between the proportion estimates and ground truth estimates. When testing the variances of the machine estimates, a significant reduction in the variances was found when the number of starting dots was increased from 30 to 45. The variances were again reduced, although not significantly, when the number of starting dots was increased from 45 to 60. From these results, 60 starting dots are recommended for a three-category classifier. When examining the variances of the estimates for the four estimation procedures (using 60 dots), no significant differences were found between procedures. Thus, only the machine clustering may be used to produce an estimate, and the stratified areal estimate computations and maximum likelihood classification can be deleted.

**N80-18510*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LACIE TRANSITION YEAR PLAN FOR THE DIRECT ESTIMATION OF WHEAT FROM LANDSAT IMAGERY**
R. K. Lennington, N. E. Marquina, D. T. Register, and M. C. Kinsler, Principal Investigators Mar. 1979 51 p Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10059; NASA-CR-160426; JSC-14553; LEC-11861)
Avail: NTIS HC A04/MF A01 CSCL 02C

**N80-18511*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**IMPLEMENTATION OF BADHWAR CLASSIFICATION OF CORN/SOYBEAN SEGMENTS**
Willa W. Austin, Principal Investigator Oct. 1979 32 p refs ERTS
(Contract NAS9-15800)
(E80-10060; NASA-CR-160425; JSC-16274; LEC-14064)
Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-18513*#** Texas A&M Univ., College Station. Remote Sensing Center.
**CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Progress Report, Feb. - Aug. 1979**
Bruce J. Blanchard, Principal Investigator Aug. 1979 66 p refs ERTS
(Grant NsG-5193)
(E80-10063; NASA-CR-162585; RSC-3622-2) Avail: NTIS HC A04/MF A01 CSCL 08M

**N80-18514*#** Texas A&M Univ., College Station. Remote Sensing Center.
**MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Jun. 1979 - 1 Jan. 1980**
Bruce J. Blanchard, Principal Investigator 1 Jan. 1980 71 p ERTS
(Grant NsG-5134)
(E80-10064; NASA-CR-162586; RSC-3458-4) Avail: NTIS HC A04/MF A01 CSCL 08M

The author has identified the following significant results. Cursory examination of the data indicates that the listed row tillage practices at 90 deg to the radar beam are approximately 12.5db higher than other comparable agricultural land. The Seasat radar data show evidence that the high return occurs only at a narrow range in look direction near the 90 deg. Such a high increase in return compared to a 15db range in film response would indicate that rows seen crosswise would saturate optically processed data. This response to row direction will have an adverse effect on monitoring agricultural lands with L band radar systems. Preliminary examination indicates that there is no sensitivity to soil moisture at the 5 deg look angle when using a like-polarized L band system. Some sensitivity was evident at a look angle of 20 deg and only a weak sensitivity was indicated at 40 deg look angle. At both 20 deg and 40 deg there is a significant response to soil moisture and none to row direction. Steep angles or the 5 deg look angle using cross polarized (HB) L band system appear insensitive to row direction and soil moisture.

**N80-18515*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Jul. - 30 Sep. 1979**
R. P. Mroczynski, Principal Investigator 30 Sep. 1979 56 p
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS9-15325)
(E80-10065; NASA-CR-160435; LARS-093079) Avail: NTIS HC A04/MF A01 CSCL 02F

**N80-18518*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**LACIE EVALUATION AND OUTLOOK PANEL TRANSCRIPT: THE LACIE SYMPOSIUM**
1978 22 p refs Symp. held at Houston, Tex., 23 Oct. 1978 Sponsored by NASA, NOAA, and USDA ERTS
(E80-10069; NASA-CR-162641; JSC-13769) Avail: NTIS HC A02/MF A01 CSCL 02C

**N80-18519*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). BIBLIOGRAPHIC ADDENDA, TECHNICAL REPORTS, PAPERS, AND MEMORANDUMS PUBLISHED UNDER SUPPORTING RESEARCH AND TECHNOLOGY AND OTHER RESEARCH, TEST, AND EVALUATION CONTRACTS FOR THE EARTH OBSERVATIONS DIVISION**
J. B. Aumann, Principal Investigator May 1978 37 p ERTS
(Contract NAS9-15200)
(E80-10070; NASA-CR-160423; JSC-14278; LEC-11651) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-18521*#** Department of Agriculture, Weslaco, Tex. Science and Education Administration.
**PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Sep. - 1 Dec. 1979**
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Dec. 1979 8 p HCMM
(NASA Order S-4019-8B)
(E80-10072; NASA-CR-162643) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Procedures to edit cloud-contaminated pixels from those pixels representing Earth surface features were investigated. Because clouds are more reflective than Earth features and are colder than Earth surface features most of the year at 26 N latitude, either a raw digital count ratio or a ratio of reflectance percentage for the VIS band to the temperature works well. For this procedure, the two bands of data need to be registered to the ground scene.

**N80-18523*#** Texas A&M Univ., College Station. Remote Sensing Center.
**DRYLAND PASTURE AND CROP CONDITONS AS SEEN BY HCMM Progress Report, Jul. - Oct. 1979**
W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Oct. 1979 13 p HCMM
(Contract NAS5-24383)
(E80-10074; NASA-CR-162645; PR-3712-7) Avail: NTIS HC A02/MF A01 CSCL 02C

**N80-18525*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET DATA BASE FOR SPRING AND WINTER WHEAT, VOLUME 2**
M. H. Trenchard, M. L. Sestak, M. C. Kinsler, and D. E. Phinney, Principal Investigators Jun. 1979 194 p Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10076; NASA-CR-160437; JSC-14901-Vol-2; LEC-13393-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 02C

**N80-18526*#** Texas A&M Univ., College Station. Dept. of Mathematics.
**AGRISTARS: A JOINT PROGRAM FOR AGRICULTURE AND RESOURCES INVENTORY SURVEYS THROUGH AEROSPACE REMOTE SENSING. DEVELOPMENT AND EVALUATION OF CLUSTERING PROCEDURES Final Report**
L. F. Guseman, Jr., Principal Investigator Nov. 1979 110 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-14689)
(E80-10079; NASA-CR-160427; SR-T9-00402) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-18528*#** Texas A&M Univ., College Station. Dept. of Mathematics.
**THE EASY REMOTE SENSING PROBLEM Final Report**
L. F. Guseman, Jr., Principal Investigator and Jack Bryant *In its* AgRISTARS: A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 52 p refs ERTS

(Rept-20) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-18529*#** Texas A&M Univ., College Station. Dept. of Mathematics.
**THE CRAMER-RAO LOWER BOUND AS A CRITERIA FOR EVALUATING A LARGE DATA REDUCTION SYSTEM SUCH AS LACIE Final Report**
L. F. Guseman, Jr., Principal Investigator and Patrick L. Odell (Texas Univ. at Dallas) *In its* AgRISTARS: A Joint Program for Agriculture and Resource Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 24 p refs ERTS

(Rept-21) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-18530*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EFFECT OF SOIL TEXTURE ON THE MICROWAVE EMISSION FROM SOILS**
Thomas Schmugge Jan. 1980 32 p refs
(NASA-TM-80632) Avail: NTIS HC A03/MF A01 CSCL 08M

The intensity brightness temperature of the microwave emission from the soil is determined primarily by its dielectric properties. The large difference between the dielectric constant of water and that of dry soil produces a strong dependence of the soil's dielectric constant on its moisture content. This dependence is effected by the texture of the soil because the water molecules close to the particle surface are tightly bound and do not contribute significantly to the dielectric properties. Since this surface area is a function of the particle size distribution (soil texture), being larger for clay soils with small particles, and smaller for sandy soils with larger particles; the dielectric properties will depend on soil texture. Laboratory measurements of the dielectric constant for soils are summarized. The dependence of the microwave emission on texture is demonstrated by measurements of brightness temperature from an aircraft platform for a wide range of soil textures. It is concluded that the effect of soil texture differences on the observed values can be normalized by expressing the soil moisture values as a percent field capacity for the soil. A.R.H.

**N80-18531#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**APPLICATION OF STATISTICAL CORRELATION IN THE STUDY OF AVAILABLE WATER IN LAYERS OF CERRADO SOIL [APLICACAO DE MODELOS DE ANALISE ESTATIS-**

**TICA COM ESTRUTURA CORRELACAO EM ESTUDOS DE DISPONIBILIDADE DE AGUA EM SOLO DOS CERRADOS]**
Joel Neves Barreto Oct. 1979 206 p refs In PORTUGUESE; ENGLISH summary
(INPE-1607-TDL/014) Avail: NTIS HC A10/MF A01

The use and extension of the method of time series analysis, as illustrated by the application to studies of the influence of density of planting on the availability of water in different layers of 'Cerrado' soil, is proposed. Three models are elaborated, that take into account, isolated or jointly, the experimental errors correlated both serial and contemporaneously. It is concluded that, for the data analyzed, the averages of the densities, layers and interactions, differ in behavior when analyzed together. The use of this method of analysis, by the adoption of models with correlated errors, is an answer, in specific instances, to the convenience of developing alternate methods of analysis which take into consideration a more adequate correlation structure.
M.M.M.

**N80-18532#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**SIGNIFICANT RESULTS FROM A PROJECT ON AGRICULTURAL STATISTICS, 1975 - 1978 [RESULTADOS SIGNIFICANTES DO PROJETO ESTATISTICAS AGRICOLAS: 1975 - 1978]**
Francisco Jose Mendonca, David Chung Liang Lee, Antonio Tebaldi Tardin, Sherry Chou Chen, Rene Antonio Novaes, and Yosio Edemir Shimabukuro Oct. 1979 29 p refs In PORTUGUESE; ENGLISH summary
(INPE-1609-NTE/155) Avail: NTIS HC A03/MF A01

Results acquired by the staff of the Agricultural Statistics Project between 1975 and 1978 are presented. During this period color infrared images and LANDSAT data were interpreted in order to obtain crop identification and area estimates. M.M.M.

**N80-19587*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**QUANTITATIVE ESTIMATION OF PLANT CHARACTERISTICS USING SPECTRAL MEASUREMENT: A SURVEY OF THE LITERATURE**
R. B. Cate, J. A. Artley, and D. E. Phinney, Principal Investigators Jan. 1980 43 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10078; NASA-CR-160460; LEMSCO-14077; JSC-16298; SR-LO-00408) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-19588*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LANDSAT DIGITAL ANALYSIS OF THE INITIAL RECOVERY OF THE KOKOLIK RIVER TUNDRA FIRE AREA, ALASKA**
D. K. Hall, J. P. Ormsby, L. Johnson (Army Cold Regions Research and Engineering Lab., Fairbanks, Alaska), and J. Brown, Principal Investigators (Army Cold Regions Research and Engineering Lab., Hanover, N. H.) Dec. 1979 21 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10080; NASA-TM-80602) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Considerable regrowth of vegetation was observed between August 1977 and August 1978, both in the field and through analysis of LANDSAT near infrared digital data. The spectral reflectances in the burned areas were found to increase with the age of the burn in a one year period due to vegetation regrowth. Regrowth was particularly evident in the lightly burned portions of the burned area. Image analysis techniques using the AOIPS system permitted delineation of burn severity categories. The conditions and type of ground cover prior to the fire influenced the severity of burning, as did the direction of the winds while the burning was in progress as determined from field and LANDSAT observations. More severe burning was induced by winds blowing in the northeastern and southeastern portions of the burned area.

**N80-19590*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A CRITICAL COMPARISON OF REMOTE SENSING AND OTHER METHODS FOR NONDESTRUCTIVE ESTIMATION OF STANDING CROP BIOMASS**
C. J. Tucker, Principal Investigator Dec. 1979 15 p refs Submitted for publication ERTS
(E80-10082; NASA-TM-80607) Avail: NTIS HC A02/MF A01

**N80-20763*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REMOTE MONITORING OF FOREST COVER CONDITIONS**
D. Williams, S. Wharton, and R. Nelson, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 209-212 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 02F

**N80-20768*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REMOTE SENSING OF LEAF WATER CONTENT IN THE NEAR INFRARED**
Compton J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 230-234 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 06C

The author has identified the following significant results. Simulated spectral reflectances using different leaf water contents resulted in different reflectance changes in the 0.7 to 2.5 micron region of the spectrum. Consideration of the solar spectral irradiance and atmospheric transmission characteristics shows that the 1.55 to 1.75 micron spectral interval is the best suited band in the 0.7 to 2.5 micron region for monitoring plant canopy water status from space platforms. The 1.48 to 1.75 micron spectral interval is the best suited band for ground-based monitoring of plant canopy water status. The 1.50 to 1.63 micron region shows the greatest spectral radiance changes with a simulated leaf dehydration.

**N80-20769*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PLANT STRESS AND RELATIONSHIPS TO SPECTRAL RESPONSES**
J. B. Schutt, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 235-237 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 06C

The author has identified the following significant results. Comparison of the near infrared reflectance curves of cotton plants grown in a chamber, greenhouse, and in the field show that field cotton has the lowest relfectance over the regions from 0.8 to 1.3 microns and 1.92 to 2.5 microns, with greenhouse and growth chamber spectra with higher reflectances in respective order. The reflectance levels from 1.42 to 1.92 microns (1.55 to 1.75 microns) were independent of lighting conditions. Spectral response curves recorded in the near-UV and near-IR regions for tomato leaves subjected to O3, SO2, and their combination, show that greater consistency in detectability was found in the new-UV. Results show that visible damage first appeared at the upper surface of a leaf, while incipient damage was first detected at the under surface.

**N80-20770*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MONITORING DROUGHT IN COLORADO WITH LANDSAT MSS**

C. J. Tucker and D. W. Deering, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 238-241 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08H

**N80-20771*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EFFECTS OF WHEAT IRRIGATION FREQUENCY ON REFLECTANCE IN SELECTED SPECTRAL BANDS**
E. W. Chappelle, F. W. Wood, and W. W. Newcomb, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 242-246 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20772*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OFF-NADIR VIEWING EFFECTS ON SPECTRAL ASSESSMENT OF GREEN BIOMASS**
D. W. Deering, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 247-251 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

The author has identified the following signficant results. Off-nadir pointing of remote sensors decreased the red radiance and increased the infrared radiance in a situation of sparse ground cover and low levels of green biomass by increasing the proportion of the measured spectral response that was affected by interaction with the plant material component of the vegetation scene. The magnitude of the spectral radiance value changes with changes in off-nadir viewing angle indicate that from 0 deg to 20 deg no significant radiometric adjustments are necessary, but at larger veiw angles, adjustment-to-nadir algorithms may be necessary for many applications. The infrared/red ratio vegetation index exhibited enhanced sensitivity to the green biomass in low biomass situations.

**N80-20773*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THERMAL ANISOTROPY OF VEGETATION CANOPIES**
D. S. Kimes, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 252-256 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 02F

**N80-20774*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**TIME OF DAY EFFECTS ON WHEAT REFLECTANCE IN FIFTEEN SELECTED BANDS**
E. W. Chappelle, F. W. Wood, and W. W. Newcomb, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 257-259 ERTS

Avail NTIS HC A14/MF A01 CSCL 02C

**N80-20775*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ASSESSING SOYBEAN LEAF AREA AND LEAF BIOMASS BY SPECTRAL MEASUREMENTS**
B. N. Holben, C. J. Tucker, and C. Fan, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 260-263 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

The author has identified the following significant results. Red and photographic infrared spectral radiances were correlated with soybean total leaf area index, green leaf area index, chlorotic leaf area index, green leaf biomass, chlorotic leaf biomass, and total biomass. The most significant correlations were found to exist between the IR/red ratio data and green leaf index and/or green leaf biomass ($r2 = 0.85$ and 0.86 respectively).

**N80-20776*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**RELATIVE SENSITIVITY OF FIFTEEN SPECTRAL BANDS TO CHANGES IN SOYBEAN CANOPY COVER FOR WET AND DRY SOILS**
E. W. Chappelle, R. Bell, F. W. Wood, D. W. Deering, and M. Labovitz, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 264-268 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20777*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**RADIOMETRIC RESOLUTION FOR MONITORING VEGETATION: HOW MANY BITS ARE NEEDED?**
C. J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 269-275 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

The author has idenfified the following significant results. The solar zenith angle has an effect on the noise equivalent change in reflectance. Two hundred fifty-six quantizing levels gave a 1% to 3% improvement per channel over 64 quantizing levels, and a 1% improvement per channel over 128 quantizing levels. No improvements were found for 256 vs 512 levels. Either 128 or 256 quantizing levels appear optimum for orbital monitoring of terrestrial vegetation for thematic mapper bands 3 and 4, or similar sensor bands. However, the data rate for 256 quantizing levels is 12.5% higher than the data rate for 128 levels, other parameters being equal. The thematic mapper was found to be closely matched to the scene dynamic radiance range for targets without incorporating variable gain control in the instrument.

**N80-20778*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THEMATIC MAPPER VERSUS MULTISPECTRAL SCANNER FOR CROP MONITORING**
B. L. Markham, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 276-280 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20779*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SPECTRA OF ISOLATED VEGETATIONAL CONSTITUENTS**
E. W. Chappelle and F. W. Wood, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 281-282 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20780*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**A SPECTRAL METHOD FOR DETERMINING THE PERCENTAGE OF GREEN HERBAGE MATERIAL IN CLIPPED SAMPLES**

C. J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 283-286 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20781*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**EVALUATION OF A SPECTRAL METHOD FOR PERCENTAGE GREEN DETERMINATION USING CLIPPED RANGELAND FORAGE SAMPLES**

D. W. Deering, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 287-290 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-21613#** National Bureau of Standards, Boulder, Colo.

**HIGH RESOLUTION SENSING TECHNIQUES FOR SLOPE STABILITY STUDIES Final Report, Oct. 1976 - Sep. 1978**

Ramon L. Jesch, Robert B. Johnson, Donald R. Belsher, Arthur D. Yaghjian, and Michael C. Steppe Jan. 1979 142 p refs (FHWA Order 7-3-0001)

(PB80-124621; FHWA/RD-79/32) Avail: NTIS HC A07/MF A01 CSCL 13B

A four phase evaluation of high resolution remote sensing techniques for application to problems of determining slope stability is presented. The first two phases concentrated on documenting the subsurface features and associated characteristics which determine or influence slope stability. A variety of electromagnetic and acoustic remote sensing techniques which exhibited the greatest potential for detecting the subsurface features and characteristics were surveyed in phase three. Two techniques were chosen for further experimental and developmental pursuit: the existing FM-CW radar system, and the planar near field reconstruction approach. The existing FM-CW radar system was applied and analyzed in a series of field experiments to determine the subsurface structure at a designated test site in phase four. GRA

**N80-21817#** European Space Agency, Paris (France).

**SATELLITE CONTRIBUTION TO THE STUDY OF THE PHYSICAL PROPERTIES OF SOILS. UTILIZATION IN THE WATER AND AGRICULTURAL DOMAINS [APPORT DES SATELLITES A L'ETUDE DES PROPRIETES PHYSIQUES DES SOLS. UTILISATION DANS LES DOMAINES DE L'EAU ET L'AGRICULTURE]**

Y. Vuillaume (Groupement pour le Develop. de la Teledetection Aerospatiale) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 183-189 refs In FRENCH

Avail: NTIS HC A12/MF A01

The utilization of satellite observation for improving the knowledge of renewable resources is examined. The physical properties of the soil which are accessible to remote detection are reviewed and the utilization of satellite data for evaluation of water and agricultural resources is analyzed. Author (ESA)

**N80-21818#** Joint Research Centre of the European Communities, Ispra (Italy).

**AGROMETEOROLOGICAL APPLICATIONS [APPLICATIONS AGROMETEOROLOGIQUES]**

G. Frayesse *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 191-197 refs In FRENCH; ENGLISH summary

Avail: NTIS HC A12/MF A01

Insolation, soil moisture, precipitation, evapo-transpiration and canopy temperature (stress-degree-day concept) are analyzed for their importance in agromet models. The integration of data provided by meteorological and Earth observation satellites agricultural information systems is discussed. Author (ESA)

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# 02

# ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

**Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.**

**A80-22138 Karhunen-Loève analysis of multispectral data from landscapes.** J. Duvernoy (Franche-Compté, Université, Besançon, France) and J. Leger (California, University, La Jolla, Calif.). *Optics Communications,* vol. 32, Jan. 1980, p. 39-44. 6 refs. NSF-supported research.

Statistical properties of the chromatic spectrum of landscapes are studied by Karhunen-Loève (K.L.) transform. The information is found to be compressed into a few dominant eigenvectors of the covariance matrix of multispectral data. Natural and man-made objects are shown to differ by their covariance and therefore by the distribution of their eigenvalues. Feature selection is performed by using the first eigenvector as a chromatic filter. The respective influences of three elements of the landscapes considered (i.e. vegetation, sky, and cars in a parking lot) are assessed. Further applications to the automatic classification of the content of landscapes are discussed, and a hypothesis is proposed for the origin of the chromatic response of the human eye. (Author)

**A80-22400 # Remote sensing of regional air pollution from satellites.** E. Friedman, J. Gupta, and E. Keitz (Mitre Corp., Metrek Div., McLean, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 419-431.

It is noted that recent scientific interest in the processes of long-range transport of air pollutants has suggested the extensive application of remote sensing methods. Satellite remote sensing of pollutant gases in the troposphere is shown to have advantages in contributing to such studies. A model is developed for calculation of the data quality which might be achieved from such a satellite observation system. A nonsunsynchronous orbit is assumed, as would be the case for the Space Shuttle. Finally, the calculations include the effects of incomplete sampling, instrument response to a varying scene, cloudiness and instrument error. M.E.P.

**A80-22403 # Integration of remote sensing and geographic information systems.** R. L. Shelton (Michigan State University, East Lansing, Mich.) and J. E. Estes (California, University, Santa Barbara, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 463-483. 11 refs.

Some specific, reasonably well established applications of remote sensing are reviewed. Technical and administrative issues related to remote sensing input into computer-based information systems are outlined, and some concepts appropriate to the design and implementation of integrated systems are discussed. V.P.

**A80-22422 # The use of remote sensing in the determination of beach sand parameters.** C. F. Davis, R. A. Shuchman, and G. H. Suits (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 775-788. Contract No. N0014-74-C-0273.

Beach sands were analyzed with the intention of determining not only mineralogy but also moisture and grain size. These three parameters are of interest from a beach trafficability and sediment transport point of view. Using the information obtained from an AQUASAND model, the mineralogy, moisture, and grain size (MOGS) algorithm was developed using reflectance spectra measured on a Cary 14 spectrophotometer. The MOGS algorithm was evaluated both on the reflectance spectra from which it was derived and on spectra collected following the algorithm development. In addition, digital images of grain size distribution and moisture distribution were developed from actual multispectral scanner data. V.T.

**A80-22426 # Terrain evaluation for environmental inventory and impact assessment.** K. J. Lyons (Western Australian Institute of Technology, South Bentley, Australia). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 835-844.

Western Australia has a need for a rapid method of providing definitive information for the environmental impact assessment (EIA) process, without relying on extensive amounts of available data. The method considered in the present paper is based on small-scale aerotriangulated photography, coupled with terrain evaluation. The main approaches to terrestrial evaluation are compared against the requirements of the EIA process. V.P.

**A80-22431 # Land cover classification of Sagami River basin using Landsat data - An operational research.** H. Shimoda, T. Sakata, T. Hosomura (Tokai University, Hiratsuka, Japan), S. Murai (Tokyo, University, Tokyo, Japan), M. Yanagisawa (National Land Agency, Tokyo, Japan), and K. Murano (Ken Research, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 891-901.

Results of land cover classification of the Sagami River (Japan) basin produced by remote sensing are presented. The Landsat image data showed high geometric and shadow-free classification accuracy achieved with precise geometric correction, intensive test area selection, and man-machine interactive iterative tree structure classification. A feasibility study of high-altitude airborne sensing utilizing a color infrared photograph showed its high potential for large-scale land use mapping. A.T.

**A80-22444 # Thematic adaptive spatial filtering of Landsat landuse classification results.** K. I. Itten and F. Fasler (Zürich, Universität, Zurich, Switzerland). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1035-1042. 8 refs.

The paper examines the use of simple low-cost thematic adaptive filtering in the space domain to correct systematic as well as nonsystematic errors which appear in digital landuse classifications. It is shown that concurrently scale dependent generalization can be performed. The method is based on the use of individually formed classwise filters, consisting of two-dimensional specifically weighted arrays. Finally, the results of an application in northeastern Switzerland are presented and discussed. M.E.P.

**A80-22445 # Land use/cover changes in the Kainji Reservoir area /Nigeria/.** D. Rodriguez Bejarano and F. E. Okoye (Michigan, University, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1043-1053.

The removal of tropical vegetative cover as a result of human activities (agriculture, livestock, and urban uses) can cause immediate socio-economic and ecological problems. Some of these problems are now being encountered in the Kainji Reservoir area in Nigeria, and may impair the ability of the reservoir to meet its intended purposes. The objectives of the study described in this paper were to determine the accuracy with which small-scale remote sensor data can be used to determine the location and extent of land cover/use changes in the areas surrounding the reservoir, and to determine the change in water surface area in the reservoir. Visual and machine-assisted interpretations of multi-date, multi-band Landsat and side-looking airborne radar (SLAR) imagery were utilized. (Author)

A80-22452 # **Measuring ecological changes in multitemporal Landsat data using principal components.** G. D. Lodwick (New South Wales, University, Sydney, Australia). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1131-1141. 19 refs.

It is shown that seasonal changes can be measured using the first two principal components by differencing the scores between successive images or by linear regression across a number of images. By devising a mathematical formula to model these changes, it is found that all seasonal variations in scores on the first principal component can be explained solely by variations in sun/slope/aspect geometry. On the other hand, changes in second principal component scores appear to be wholly related to changes in ecology due to seasonal climatic effects, or caused by living agencies, including man. V.P.

A80-22462 # **An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs.** R. Hill-Rowley and W. R. Enslin (Michigan State University, East Lansing, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1251-1259. 12 refs.

A80-22468 # **Urban environmental survey by remote sensing.** K. Narigasawa and M. Fuchimoto (Asia Air Survey Co., Ltd., Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich, April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1317-1335. Research sponsored by the Geographical Survey Institute of Japan.

The paper describes remote sensing techniques and experimental evaluation techniques being used in an urban environmental survey. Attention is given to six areas of urban environment which are evaluated or investigated: (1) vegetation cover, (2) effective duration of possible sunlight, (3) sky amount and open space, (4) tree damage, (5) ground temperature (during a summer day), and (6) stability of various ground conditions (rock, sand, etc.). Attention is given to the investigative procedures and it is reported that good results were produced. Some of these were compared with results produced by other methods and were found to agree. M.E.P.

A80-22479 # **Landsat applications to land use mapping of the Cul de Sac Plain of Haiti.** R. Lafortune, F. Seme (Department of Agriculture, Haiti), and R. Laurin (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1465-1477.

Satellite data collected in February 1975 were used to prepare a land use/land cover map of the Cul-de-Sac Plain in central Haiti - a 480 square kilometer area characterized by a wide range of ecological and cultural conditions. Manual interpretation of the tones and patterns of digitally-enhanced false color imagery resulted in a twenty category generalized land use map. Automatic scene classification of the Landsat data yielded seventeen detailed terrain/land cover categories. In this area of mixed environments, the combination of manual interpretation and automatic classification was found to be optimal for preparation of land use/land cover maps. Manual interpretation allowed delineation of broad areas of similar land use, while automatic processing was required for precise definition of detailed land cover boundaries and areal tabulation of the many small spatial units. (Author)

A80-22492 # **The elimination approach to monitoring urban growth from Landsat data.** P. Carter (Atomic Energy Research Establishment, Harwell, Oxon, England) and M. J. Jackson ((Department of Environment, London, England). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1609-1617. 6 refs. Research supported by the Department of Environment.

Research into the use of Landsat data for urban monitoring is described. Although the classification of a single Landsat scene, using only the multispectral data, can provide information about urban areas, the accuracy obtained is often too low for monitoring purposes. It is shown that by limiting the area of search for new growth to the periphery of the old urban boundary, by taking decisions on the basis of the data from more than one scene, and by including other procedures described, it is possible to achieve adequate accuracy. M.E.P.

A80-22493 # **National land use and settlement assessment - An areal data base model for Landsat information for Bangladesh.** M. I. Chowdhury and S. D. Shamsuddin (Jahangirnagar University, Bangladesh, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1619-1628. 7 refs.

There is a need in Bangladesh for an integrated system of data acquisition, storage, retrieval, and analysis, where existing techniques are suitably combined with Landsat technology. In the present paper, a hierarchical land use classification is proposed to achieve such an integrated system. It is suitable for qualitative and quantitative analysis in four scales - 1:1,000,000 for Landsat imagery, 1:50,000 for topographic maps, 1:30,000 for aerial photography, and 1:3960 for cadastral survey maps. V.P.

A80-24074 **New earth resource monitoring techniques (Nouvelles techniques pour la surveillance des ressources naturelles).** L. C. Goodfellow, F. E. Guertin (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and D. Robert (Intera Environmental Consultants, Ltd., Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 241-250. 7 refs. In French.

The paper deals with the development of methods of correcting multispectral Landsat imagery for effects caused by changes in the atmosphere and illumination between two images. The detection of environmental changes by superposing two digital images and controlling color variations of IR aerial photography is discussed, along with methods of combining the four bands of digital Landsat MSS data to provide a means of improving color composites for visual interpretation. V.P.

A80-25568 * **California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames.** N. A. Bryant, R. G. McLeod, A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and H. B. Johnson (U.S. Bureau of Land Management, Riverside, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 69-79. 12 refs. Contract No. NAS7-100.

Procedures for adjustment of brightness values between frames and the digital mosaicking of Landsat frames to standard map projections are developed for providing a continuous data base for multispectral thematic classification. A combination of local terrain variations in the Californian deserts and a global sampling strategy based on transects provided the framework for accurate classification throughout the entire geographic region. C.F.W.

**A80-25572 *** **A non-interactive approach to land use determination.** V. R. Algazi, G. E. Ford, and D. I. Meyer (California, University, Davis, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 122-131. 9 refs. Grant No. NsG-5092.

An operational procedure for use by the Corps of Engineers to acquire land use information for hydrologic planning purposes is described. The operational constraints preclude the use of dedicated, interactive image processing facilities. The procedure combines manual interpretation techniques and the batch-mode computer analysis of Landsat digital data. An example of the application of the procedure to an urban watershed is described. (Author)

**A80-25574** **A methodology for a national coverage land use study by computer.** J. A. Diez, S. A. Rivera, and M. Medina (Comisión del Plan Nacional Hidráulico, Mexico City, Mexico). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 142-148. 6 refs.

The methodology used with a computerized satellite imagery interpretation system in the development of a land use inventory for Mexico based on Landsat MSS computer compatible tapes is presented. The procedure consists of the identification and selection of sample zones, the location of the zones, the definition of representative subimages for analysis or verification, and the computer classification of the images. The computer processing involves the unsupervised classification of each subimage, the merging of subimage classes, and the supervised classification of the merged statistics. The results of the processing are then evaluated by comparison with peripheral information and printout features. Ground truth is obtained by means of aerial surveys and interpretation accuracy is determined by tests of classification hypotheses and a hit-error test. It is observed that the methodology is suitable for land use classification, and may be used, with appropriate modifications, for soil, water quality and crop estimation studies. A.L.W.

**A80-25575 *** **The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants.** H. F. Fostel, J. E. Manley, and J. P. Ormsby (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Science, Greenbelt, Md.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 149-158.

**A80-25601** **Classification of areas using pixel-by-pixel and sample classifiers.** R. Kumar, M. Niero, A. P. Manso, L. A. M. Lucht, and M. S. Santiago Barros (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 420-428. 15 refs.

A comparison of the area classification accuracy using pixel-by-pixel and sample classifiers is presented. The several options of image classification including a pixel-by-pixel maximum likelihood gaussian classifier, a sample classifier based on the generalized maximum likelihood approach, and the pixel-by-pixel single cell acquisition option of the Image-100 system are discussed. Landsat multispectral scanner data of three test sites in Brazil were classified, showing that the sample classifier yielded better classification accuracy than the maximum likelihood gaussian classifier or the single-cell signature acquisition option. A.T.

**A80-27430** **Settlement detection with radar imagery.** F. M. Henderson and M. A. Anuta (New York, State University, Albany, N.Y.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 89-104. 7 refs.

The paper examines the detectability of settlements and factors influencing their visibility using imagery from two side-looking airborne radar systems. K-band and X-band imagery of diverse areas in the US are examined to discover the minimum population needed for a settlement to be consistently detected. Percent of settlements visible by size of population are calculated and results indicate that imagery at a scale of 1:200,000 or larger is requisite for settlement detection, so that 60-70 percent of settlements with 200-300 population can be identified with accuracies rising as population increases. Environmental characteristics were of little or no significance in explaining variation in settlement detection except for the effect of vegetation on selected settlements. A.T.

**A80-27457** **Effects of interpretation techniques on land-use mapping accuracy.** F. M. Henderson (New York, State University, Albany, N.Y.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Mar. 1980, p. 359-367. 5 refs.

Study areas in the southern U.S. were employed to examine the effects on land-use mapping accuracy of nine different interpretation methods based on a grid cell matrix. Specifically, the effects of grid placement or orientation, of cell size, and of method used to assign land use for each cell are considered in regard to the accuracy of land-use determination. Best results were not always obtained with the smallest grid cell; interpretation techniques less complex than stratified systematic unaligned sampling often produced more accurate data. In addition, the optimum interpretation technique was found to vary among sites and category but not in a consistent manner. J.P.B.

**A80-30925** **Urban residential ground cover using Landsat digital data.** B. C. Forster (New South Wales, University, Kensington, Australia). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 547-558. 21 refs.

The relationship between Landsat digital data and the percentage of various residential component covers sampled at the pixel level over the Sydney metropolitan area is examined using multiple regression analysis. It is found that linear equations (with correlations from 0.45 to 0.66) relating response in each band to changes in cover percentages are more explanatory than those using total cover percentages. Various response combinations are verified by computing the optimum combinations for predicting individual cover percentages, with correlations ranging from 0.33 for concrete percentage to 0.72 for grass and tree percentage combined. It is also found that by incorporating an average background effect more reliable estimates of the reflectance of cover types are obtained. L.M.

**A80-32273 #** **Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs (Opyt primeneniia avtomaticheskoi klassifikatsii dlia deshifrirovaniia pustynnykh i polupustynnykh landshaftov Zapadnogo Kazakhstana po snimkam s kosmicheskogo korabliа 'Soiuz-12').** M. B. Averintsev and V. I. Kravtsova. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 72-76. In Russian.

**A80-32275 #** **Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment (Rezul'taty predvaritel'noi kompleksnoi geograficheskoi interpretatsii materialov mnogozonal'noi s'emki, poluchennykh s KK 'Soiuz-22' v sovmestnom eksperimente SSSR i GDR 'Raduga').** K. A. Salishchev, S. S. Voskresenskii, E. V. Glushko, E. K. Kozlova, Iu. F. Knizhnikov, Iu. I. Kondratova, T. V. Kotova, V. I. Kravtsova, I. A. Labutina, and G. A. Sar'ianov. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 83-115. In Russian.

The present extensive analysis of space photographs of a great variety of landscapes reveals the superiority of photographs obtained (from a manned spacecraft) with a MKF 6 camera at orbit inclination angles of 65 degrees. The exclusive use of such photographs for scientific, economic, and geographic studies is suggested. V.P.

**A80-32278 #** **Investigation of landscapes of the Turgay steppe using multispectral aerial photography (Izuchenie landshaftov Turgaiskoi stepi po materialam mnogozonal'noi aerofotos'emki).** V. A. Nikolaev and T. G. Sharlai. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 129-139. In Russian.

**A80-32285 #** **The use of ordinary and multispectral aerial and space photographs for the mapping of population centers (Ispol'zovanie obychnykh i mnogozonal'nykh aerokosmicheskikh snimkov dlia kartografirovaniia sistem naselennykh punktov).** E. M. Tsypina. *(Vsesoiuznaia Konferentsiia po Kosmicheskim Lucham, Yerevan, Armenian SSR, June 1979.) Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia,* vol. 43, Dec. 1979, p. 215-224. In Russian.

**N80-16575*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SUMMARY OF AIRCRAFT RESULTS FOR 1978 SOUTHEASTERN VIRGINIA URBAN PLUME MEASUREMENT STUDY OF OZONE, NITROGEN OXIDES, AND METHANE**
Gerald L. Gregory, Dewey E. Wornom, Joe J. Mathis, Jr., and Daniel I. Sebacher Washington Feb. 1980 222 p refs
(NASA-TM-80146; L-12981) Avail: NTIS HC A10/MF A01 CSCL 13B

Ozone production was determined from aircraft and surface in situ measurements, as well as from an airborne laser absorption spectrometer. Three aircraft and approximately 10 surface stations provided air-quality data. Extensive meteorological, mixing-layer-height, and ozone-precursor data were also measured. Approximately 50 hrs (9 flight days) of data from the aircraft equipped to monitor ozone, nitrogen oxides, dewpoint temperature and temperature are presented. In addition, each experiment conducted is discussed. A.R.H.

**N80-16576*#** Research Triangle Inst., Research Triangle Park, N. C.
**ALTITUDE CHARACTERISTICS OF SELECTED AIR QUALITY ANALYZERS Final Report**
J. H. White, R. Strong, and J. B. Tommerdahl Nov. 1979 32 p
(NASA Order L-96783-A; RTI Proj. 43U-1833)
(NASA-CR-159165; RTI/1833/00-03F) Avail: NTIS HC A03/MF A01 CSCL 13B

The effects of altitude (pressure) on the operation and sensitivity of various air quality analyzers frequently flown on aircraft were analyzed. Two ozone analyzers were studied at altitudes from 600 to 7500 m and a nitrogen oxides chemiluminescence detector and a sulfur dioxide flame photometric detector were studied at altitudes from 600 to 3000 m. Calibration curves for altitude corrections to the sensitivuty of the instruments are presented along with discussion of observed instrument behavior. K.L.

**N80-17120*#** National Aeronautics and Space Administration, Washington, D. C.
**RESEARCH PROJECT MAURETANIA: SATELLITES AS DEVELOPMENT AIDS**
Rupert Haydn, Helmut Bonerius, and Manfred Schramm Feb. 1980 18 p Transl. into ENGLISH from Bild Wiss. (West Germany), no. 11, 1979 p 151-161 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76064) Avail: NTIS HC A02/MF A01 CSCL 22A

A general discussion is presented of how satellite images and ground surveys are used to define land use. Specifically it deals with the Tagant region in Mauretania, West Africa. R.C.T.

**N80-19582*#** Michigan State Univ., East Lansing.
**USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Annual Progress Report, 1 Jun. 1978 - 31 May 1979**
Myles Boylan, Principal Investigator 1 Feb. 1980 113 p refs ERTS
(Grant NGL-23-004-083)
(E80-10085; NASA-CR-162783) Avail: NTIS HC A06/MF A01 CSCL 05B

**N80-19598#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
**STATISTICAL ANALYSIS OF TERRAIN AND WATER (ICE) BACKGROUNDS IN A WINTER SCENE FROM NORTHERN MICHIGAN Final Report**
Anthony J. LaRocca Oct. 1979 299 p refs
(Contract N60530-79-R-0036)
(AD-A077554; ERIM-139900-2-F) Avail: NTIS HC A13/MF A01 CSCL 17/5

Data from infrared imagery on various terrain and water (ice, in this instance) backgrounds were collected and analyzed to present their statistical features. This report describes some of the characteristics in the form of histograms, ellipse 'pictures', and power spectra for the following infrared spectral bands: 3.5-3.9, 4.5-5.5, and 9.0-11.4 micrometers. Areas were chosen to show variability of results in a winter scene with respect to different times of the day and night. GRA

**N80-19599#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
**STATISTICAL ANALYSIS OF TERRAIN AND WATER BACKGROUNDS IN THE VICINITY OF PORT HUENEME, CALIFORNIA**
Anthony J. LaRocca Apr. 1979 156 p refs
(Contract N60530-78-C-0009)
(AD-A077025; ERIM-132300-3-T) Avail: NTIS HC A08/MF A01 CSCL 17/5

Data from infrared imagery on various terrain and water backgrounds have been collected by the Environmental Research Institute of Michigan and have been analyzed to present their statistical features. This work is being funded by the Optical Signatures Program to Support Navy Requirements. This report describes some of the characteristics in the form of histograms, ellipse 'pictures', and power spectra for the following infrared spectral bands: 2.0-2.6, 3.0-4.2, 4.5-5.5, and 9.0-11.4 microns. Special areas were chosen to demonstrate the variation in results with the selection of different backgrounds. GRA

**N80-20661#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE TOPOGRAPHIC SYNOPTIC MAP 1:200,000 [DIE TOPOGRAPHISCHE UEBERSICHTSKARTE 1:200,000 (TUEK 200)]**
Rolf Boehme *In its* Rept. on Cartography and Geodesy, Ser. 1: Original Rept. No. 73 1977 p 175-176 In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

The page by page development of the 1:200,000 synoptic topographic map is briefly described. Samples of this highly informative document are reproduced. Author (ESA)

**N80-20662#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE SYNOPTIC MAP 1:500,000 (WORLD, SERIES 1404) [DIE UEBERSICHTSKARTE 1:500,000 (WORLD, SERIE 1404)]**
Rolf Boehme *In its* Rept. on Cartography and Geodesy, Ser. 1: Original Rept. No. 73 1977 p 177-178 In GERMAN Original contains color illustrations
11-42)
Avail: NTIS HC A11/MF A01

The 1:200,000 synoptic map is briefly described. A sample produced by IFAG is presented as well as a sample produced by the French National Geographic Institute. Author (ESA)

**N80-20663#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE INTERNATIONAL WORLD MAP 1:1,000,000 (IWK) [DIE INTERNATIONALE WELTKARTE 1:1,000,000 (IWK)]**

Wolfgang Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 179-182 In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

The development of the 1:1000,000 world map requested by the United Nations is briefly described. Samples of the 1942 and 1977 editions of the same maps are presented.
Author (ESA)

**N80-20664#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**PHOTOGRAMMETRY IN IFAG FROM 1952 TO 1977 [DIE PHOTOGRAMMETRIE IM IFAG 1952-1977]**
Hans Belzner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 187-192 In GERMAN

Avail: NTIS HC A11/MF A01

The development of photogrammetric studies in the IFAG is reviewed. Collaboration with other institutions, in particular, with the Organisation Europeene d Etudes Photogrammetriques Experimenteles (OEEPE) is examined. Work in orthophototechniques from aircraft and satellites is described. Contributions to development in the Middle East are mentioned. Author (ESA)

**N80-20668#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**OBTAINING SURFACE INFORMATION FOR TOPOGRAPHY AND TOWN AND COUNTRY PLANNING FROM REMOTE SENSING [DAS GEWINNEN VON FLAECHENNUTZUNGS INFORMATIONEN MITTELS FERNERKUNDUNGSVERFAHREN FUER AUFGABEN DGR TOPOGRAPHIE UND DER LANDESPLANUNG]**
Klaus Niemz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 211-217 In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

Methods developed for future Earth reconnaissance flights are described and discussed. Four test regions with different characteristics were selected: test region 1 (North Germany) for oceanic and coastal studies; test region 2 (Lower Main/Taunus/Wetterau) for town and country planning applications; test region 3 (Upper Rhine/Black Forest) for vegetation and forestry applications; test region 4 (Baltic region) for geological applications. Results obtained with a Bendix-11-channel scanner are presented and compared with LANDSAT 2 data. Different crops and land uses are characterized by color separation utilizing the DIBIAS system and the maximum likelihood method.
Author (ESA)

**N80-20721*#** Commonwealth Scientific and Industrial Research Organization, Ryde (Australia).
**HEAT CAPACITY MAPPING MISSION (HCMM) Progress Report, 31 Aug. - 30 Nov. 1978**
K. G. McCracken, Principal Investigator 30 Nov. 1979 2 p Sponsored by NASA HCMM
(E80-10066; NASA-CR-162587) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-20765*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**NASA-CENSUS APPLICATION PILOT TEST (APT) AND URBAN AREA DELINEATION STUDIES**
D. Toll and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 216-219 refs ERTS (For primary document see N80-20723 11-43)
Avail: NTIS HC A14/MF A01 CSCL 13B

**N80-20862#** New Mexico Univ., Albuquerque. Technology Application Center.
**REMOTE SENSING APPLIED TO POLLUTION MONITORING. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jun. 1979**
Gerald F. Zollars Jul. 1979 51 p Sponsored in part by NTIS, Springfield, Va
(NTIS/PS-79/0732/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Articles are cited from the international literature concerning the use of remote sensors to aid in the monitoring of air and water pollution. Use of lasers, optical radar systems, aerial photography, and satellite observations are included. (Contains 194 citations)
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# 03

# GEODESY AND CARTOGRAPHY

Includes mapping and topography.

**A80-22407** # **Terrain modeling and geometric corrections using the Spot satellite.** A. Baudoin, D. Kirsner (Institut Géographique National, Saint-Mandé, Val-de-Marne, France), and J. C. Cazaux (Centre National d'Etudes Spatiales, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 537-556. 8 refs.

It is noted that the Spot satellite which is due to be launched in 1984 will have a capability to provide high resolution images and stereoscopic coverage of large areas. The paper describes the means by which the satellite will help to draw or to up date topographic maps at scales from 1:200,000 down to 1:50,000. Attention is given to the HRV sensor and its pointing capability. In addition, the three types of preprocessed images are presented and the different steps to create planimetric maps and/or digital terrain modes are analyzed. M.E.P.

**A80-22440** # **Cartography with combined Landsat and navigational satellite data.** R. K. Vincent, R. A. Harrow, and D. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 983-992.

Two methods for producing resampled computer tapes and photomap bases of high geometric accuracy from Landsat data were investigated. The first method, which simulated the use of a navigational satellite surveying instrument, can be utilized as an inexpensive two-dimensional surveying method for poorly mapped regions of the world. The second method is a map-matching method which utilizes geometrically accurate maps. Channel 5 photomap bases and map tapes were produced for the areas covered by the Ann Arbor East and Ann Arbor West 7.5 minute topo quad maps. Latitude and longitude for every resampled pixel on the map tape can be calculated by a simple linear equation. (Author)

**A80-22503** # **Production of small-scale maps and inventories using Landsat data.** S. Braconne, J. C. Lummaux, and J. Poulain (Institut Géographique National, Paris, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1757-1764.

Landsat allows one to establish accurate cartography at small scales up to 1:250,000. An interactive image processing system enables one to reduce the time and costs involved. After one year of use the first operational results obtained with the TRIAS system of the French Institut Géographique National in the field of general and thematic cartography are discussed. Two processes are presented as examples of both themes: starting from Landsat imagery they use data processing sequences to produce cartographic plates in a short time, ready for printing. (Author)

**A80-22508** * # **An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy.** J. R. G. Townshend (Reading, University, Reading, Berks., England), D. F. Williams (Fairey Surveys, Ltd., Maidenhead, Berks., England), and C. D. Justice (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1839-1852. 8 refs.

Return Beam Videcon imagery from Landsat 3 was obtained in August, 1978 for part of Southern Italy in the regions of Basilicata and Apulia. The resolution of this imagery for medium contrast objects is approximately 40 meters and is shown to provide significant information concerning land cover and fluvial morphometry. Because of the wide spectral band width which is sensed (0.505-0.750 microns) by the RBV cameras, discrimination is only possible for spectrally distinct cover types, especially oak woodland. Fluvial morphometry can be readily described using the imagery. Because of the intense dissection of the area, the lowest order streams cannot be consistently mapped, but the rank order of the measured values of properties such as drainage density and link frequency for different lithologies corresponds closely to the actual ranking. (Author)

**A80-22509** # **Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation.** E. M. El Shazly, M. A. Abdel Hady, M. A. El Ghawaby, I. A. El Kassas, M. M. El Shazly, A. B. Salman, and M. M. El Rakaiby (Remote Sensing Center; Nuclear Materials Authority, Cairo, Egypt). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1853-1860.

The paper discusses mapping of the Sinai Peninsula by Landsat-1 satellite imagery interpretation. Five basic maps were made including geological, structural lineation, drainage, petroleum and mineral potential and groundwater potential maps; the method showed particular usefulness for mountainous rugged areas which have been difficult to map due to lack of observation points. Mapping by spaceborne satellite imagery made it possible to identify petroleum, mineral, and groundwater sites, aiding in the rapid development of the Sinai Peninsula. A.T.

**A80-24810** # **Free Doppler network adjustment.** E. Grafarend, A. Kleusberg, and B. Richter (München, Hochschule der Bundeswehr, Neubiberg, West Germany). In: International Geodetic Symposium on Satellite Doppler Positioning, 2nd, Austin, Tex., January 22-26, 1979, Proceedings. Volume 2. Austin, Tex., University of Texas, 1979, p. 1053-1069. 8 refs.

The paper analyzes rank deficiencies of datum-defects, configuration-defects, and of ill-conditionedness for a Doppler-satellite network. It is shown that a Doppler satellite network in the geometric mode has a datum defect of six due to the system insensitivity with respect to translation and rotation of the reference frame. The configuration deficiency can be avoided only through a sufficient number of simultaneous observations; for more general cases, inequalities between the number of ground stations, of satellite points, and of passes are constructed and tested, especially with respect to the ill-conditionedness of the system of observational equations. A.T.

**N80-19360***# Massachusetts Inst. of Tech., Cambridge.
**THEORETICAL MODELLING AND EXPERIMENTAL DATA MATCHING FOR ACTIVE AND PASSIVE MICROWAVE REMOTE SENSING OF EARTH TERRAIN**
J. A. Kong, L. Tsang, M. Zuniga, R. Shin, J. C. Shiue, and A. T. C. Chang *In* AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 8 p refs Prepared in cooperation with NASA Goddard Space Flight Center Greenbelt, Md.
Avail: NTIS HC A17/MF A01 CSCL 20N

Two theoretical models were developed to characterize terrain media: a random medium with a variance, a horizontal correlation length; and a homogeneous dielectric containing discrete scatterers. The earth terrain is modelled as layers of such scattering media bounded by air above and half-space below. Matching the theoretical results with experimental data collected from vegetation and snow-ice fields shows that: (1) for observation angles near nadir, rough surface effects are important; (2) for snow-ice field the horizontal correlation length is greater than the vertical correlation length whereas for vegetation field their relative sizes depend on the types of vegetation; (3) the vertically polarized backscattering cross-section is always larger than the horizontally polarized backscattering cross-section for half-space scattering media; (4) for snow field displaying diurnal change, a three-layer model including a thin top layer caused by sunlight illumination must be used; and (5) for a random medium with equal horizontal and vertical correlation lengths, the measured data can also be matched with a corresponding discrete scatterer model. K.L.

**N80-20638#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORT NO. 73 [NACHRICHTEN AUS DEM KARTEN UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NR. 73]**
1977 246 p refs In GERMAN Original contains color illustrations
(Rept-73) Avail: NTIS HC A11/MF A01

Papers describing the work of the Institute for the past 25 years include a description of the satellite observation station Wettzell. Geodetic data collection from Doppler and laser distance measurements, from altimeter and gravimetric evaluations, from the study of earth tides and photogrammetry are discussed, along with the cartographic representation of these data.

**N80-20639#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE 25 YEARS AT THE INSTITUTE FOR APPLIED GEODESY [25 JANRE INSTITUT FUER ANGEWANDTE FEODAESIE (1952-1977)]**
Rudolf Foerstner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 7-37 refs In GERMAN
Avail: NTIS HC A11/MF A01

A chronological review of the important events since the foundation of the Institute 25 years ago is presented. The various phases of its organization and its relationship with other institutions are described. The goals fixed at the different stages of the IFAG's development in geodesy, mapping, and photogrammetry are examined. Author (ESA)

**N80-20640#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**A SURVEY OF THE GEODETICAL WORK OF THE IFAG FROM 1952-1977 [EIN UEBERBLICK UEBER DIE GEODAETISCHEN ARBEITEN DES IFAG (ABT. 2 DES DGFI) VON 1952-1977]**
Hermann Seeger, Rudolf Brein, Dieter Ehlert, Dieter Lelgemann, Klemens Nottarp, Bernd Richter, and Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 39-51 In GERMAN

Avail: NTIS HC A11/MF A01

Survey of the 25 years of geodetical research undertaken by the IFAG is presented. The improvement of the triangulation network and geoid determination, research on gravimetry and Earth tides, and the exploitation of data from geodetic satellites are described and future projects stated. Author (ESA)

**N80-20641#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE SATELLITE STATION WETZELL [DIE SATELLITENBEOBACHTUNGSSTATION WETTZELL]**
Hermann Seeger *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 53-62 refs In GERMAN
Avail: NTIS HC A11/MF A01

The observation station Wettzell was created in collaboration with other institutes to modernize the research techniques of the IFAG in geodesy and geodynamics. The conception, realization, and installation of the Institute are described, and the technical devices camera, and a third generation laser ranging system. Author (ESA)

**N80-20647#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**ELABORATING AN ASTRONOMICAL LONGITUDE SYSTEM [ARBEITEN AM ASTRONOMISCHEN LAENGENNETZ]**
Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 105-109 refs In GERMAN
Avail: NTIS HC A11/MF A01

The problem of astronomical longitude determination is examined. Systematic local variations in the astronomical longitude system are due to the consistency of the initial point. Relative longitude systems combination of these relative systems, comparing traditional geodetic and satellite methods eliminates errors and leads to a longitude systems homogeneous over Western Europe. Author (ESA)

**N80-20648#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**DETERMINATION OF AZIMUTH AND ASTRONOMICAL COORDINATES**
Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 111-115 refs In GERMAN
Avail: NTIS HC A11/MF A01

The determination of astronomical coordinates and azimuth from Laplace stations is examined. Observations from stations examining the vertical variation are discussed. A precision of .5 min. of arc can be reached for each component. A greater density of points will contribute more to precision than will improvements in the measurement possibilities. Author (ESA)

**N80-20660#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE DATA BANK IN THE CARTOGRAPHIC AUTOMATION SYSTEM [DIE DATENBANK IM KARTOGRAPHISCHEN AUTOMATIONSSYSTEM]**
Wigand Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 171-173 In GERMAN

in vertical photographs is discussed, and the effect of different Sun angles is shown in several photographs. Author (ESA)

**N80-20666#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**ORTHOPHOTO TECHNIQUES AND PHOTOMAPS [ORTHOPHOTOTECHNIK UND LUFTBILDKARTE]**
Rudolf Olach *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 199-201 refs In GERMAN

Avail: NTIS HC A11/MF A01

The orthophototechnique and the development of orthophotoplans and aerial photographic maps is examined. Precision in orthophotographic techniques, the applications of orthophotoplans and their structure are described. Author (ESA)

**N80-20667#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**AERIAL AND SPACE-BORNE PHOTOGRAPHIC MAPS [LUFTBILD UND WELTRAUMBILDKARTEN]**
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 203-210 refs In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

The production of topographic aerial photography and spaceborne photomaps is described. Aerial photomaps are produced from orthophotographs with additional cartographic information. Rapid execution of photomaps, and difficulties of scale reduction by classical or automatic means are mentioned as justification for aerial and spaceborne photographic mapping. Author (ESA)

**N80-20675#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**ON THE DISPLACEMENT PROBLEM AS PART OF A PROCESS IN GENERALIZING TOPOGRAHICAL MAPS. PROPOSITION FOR HIERARCHICAL ORDER AND THE**

**SEARCH FOR EDP ASSISTED SOLUTIONS [ZUM PROBLEM DER VERDRAENGUNG ALS TEILVORGANG DER GENERALISIERUNG TOPOGRAPHYISCHER KARTEN. HIERARCHIEVORSCHLAG UND VERSUCH EINER EDV-GESTUETZTEN LOESUNG]**
Roland Schittenhelm *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 5-19 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01
Based on the results obtained from the investigation of practical cases of displacement on official maps of Germany, an order is proposed for map elements which could be observed during displacement. Solutions are given for three line element displacement cases (displacement by a compulsory point, displacement by a further element which is broadened or displaces itself, disentanglement of double hairpin bends of curved and broadened line elements). These have the advantage of freeing the cartographer from many routine tasks. Author (ESA)

**N80-20676#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**TWENTY-FIVE YEARS OF AERIAL PHOTOGRAPHY BY THE INSTITUTE OF APPLIED GEODESY [JAHRE LUFTBILDNACHWEIS DES INSTITUTS FUER ANGEWANDTE GEODAESIE]**
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 21-38 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01
After a short survey of aerial photography developments in Germany after the Second World War, some details are given about the aerial photography documentation which the institute possesses. Information is also given about the number and frequency of photo flights over a period of ten years. A detailed list of aerial photographs of the German estates is presented together with a list of aerial photography archives existing in Germany. Author (ESA)

**N80-20680#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**A PROGRAM FOR THE FULLY AUTOMATED DISPLACEMENT OF POINT AND LINE FEATURES IN CARTOGRAPHIC GENERALIZATION**
Fred Christ *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 5-30 refs

Avail: NTIS HC A07/MF A01
A program for the fully automated displacement of point and line features in cartographic generalization is described. The basic algorithm is a correlation of the displacement effects of the features when deriving a small scale map from a large scale map. Raster based processing is used. K.L.

**N80-20681#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**A DIGITAL TERRAIN MODEL FOR LARGE SURFACES AND DIRECT STORAGE ACCESS**
Rainer Detering *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 31-34 refs

Avail: NTIS HC A07/MF A01
A digital terrain model based on an equidistant grid structure which uses nonlinear interpolation while storing numerical values of elevations and slopes is proposed. The model, characterized by its high storage capacity and universality, is based on bicubic spline functions. The mathematically exact solution of a common adjustment in the total domain of definition is limited in favor of a pointed interactive change of input data. Author (ESA)

**N80-20682#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE PRODUCTION OF PHOTOMAPS FROM TIDAL FLAT AREAS**
Guenter Hake *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 35-41 refs

Avail: NTIS HC A07/MF A01
Clearly visible water lines from a series of infrared aerial photographs taken at the time of rising tides in tidal flat areas are digitized and transformed into contours by the allocation of individual elevation values. The cartographic combination of the contour representation and rectified aerial photographs from the time of the lowest water level leads to a photomap with a very high information content. Changes in elevation and volume can be calculated from subsequent photographs. Author (ESA)

**N80-20683#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**TESTING THE ACCURACY OF CARTOGRAPHIC EQUIPMENT: FIRST RESULTS**
Theodor Johannsen *In its* Rept. on Cartography and Topographical Meas. Ser 2: Transl. 1978 p 43054 refs

Avail: NTIS HC A07/MF A01
Different methods of testing digitizers and plotters were developed and verified. Apart from simple tests (without the use of any additional equipment), profiles were measured with high precision using a laser interferometer. In addition, a technique was developed to establish the errors introduced by an operator when manually guiding the cursor for digitizing. It is concluded that absolute scale measurements and accurate local tests require equipment with resolution and accuracy exceeding those of the instrument to be measured by at least an order of magnitude. Author (ESA)

**N80-20685#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**LOCATIONAL CHARACTERISTICS AND THE SEQUENCE OF COMPUTER ASSISTED PROCESSES OF CARTOGRAPHIC GENERALIZATION**
Werner Lichtner *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 65-75 refs

Avail: NTIS HC A07/MF A01
A sequence of generalization processes for computer assisted operation is proposed which is intented to avoid both repetition of processes and frequent correction during batch compilation with the aid of interactive optical display systems. Particular attention is given to effects producing a lack or an excess of space and to locational changes in features and phenomena. Specific examples involving buildings and roads are discussed, as are displacement processes and the smoothing of contours and other linear phenomena. Good results are obtained with this method which has the advantage of homogeneity over manual methods. Author (ESA)

**N80-20686#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**COMPUTER-ASSISTED THEMATIC MAPPING FOR FEDERAL PLANNING**
Wolf-Dieter Rase *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 77-83 refs

Avail: NTIS HC A07/MF A01
To satisfy the needs for thematic maps on different levels of quality and quantity, computer assisted techniques were implemented in the map production process. Choropleth, graduated symbol, and other map types are plotted on an in-house minicomputer system with graphic peripherals. Remarks on the economic efficiency of computer assisted thematic cartography supplement the technical information. Author (ESA)

**N80-20688#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**EXPERIENCES GATHERED WITH A SYMBOL DISK WITH INTERCHANGEABLE SYMBOLS**
Helmut Uhrig *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 93-106 refs

Avail: NTIS HC A07/MF A01

A simple disk system that is both accurate and easily modifiable was sought. The system developed possesses 72 symbols which can be positioned by the user employing the cut and peel process or a technical method of repoduction. Specially positioned studs and holes assure that the disk is correctly centered, that the masks are in the right position, and that the unwanted part of the disk is correctly covered. A water distribution map is taken as an example. The maximum positioning error on the map itself resulting from the use of this technique is 32 microns. Author (ESA)

**N80-20690#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**MAP PROJECTION CHANGE: SOME PROGRAMS FOR THE TRANSFORMATION OF THE CONTENTS OF AVAILABLE MAPS ACCORDING TO DIFFERENT MAP PROJECTIONS**

Ingo Wilski *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 115-127 refs

Avail: NTIS HC A07/MF A01

Some FORTRAN programs are presented for the transformation of digitized map contents into geographical coordinates (Mercator and Lambert projections) and for the mass transformation of spherical geographical coordinates into rectangular map coordinates. Thirteen different map projections are considered, the graphical output being presented as a visual display and/or by a machine drawing. Author (ESA)

**N80-20702#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**THE RGST CHAIN PROGRAM FOR THE DETERMINATION OF POTENTIAL COEFFICIENTS AND STATION COORDINATES [DIE REST-PROGRAMMKETTE FUER DIE BESTIMMUNG VON POTENTIALKOEFFIZIENTEN UND STATIONSKOORDINATEN]**

Christoph Reigber *In its* Res. Program 78, Satellite Geodesy Program 1978 p 111-119 refs In GERMAN

Avail: NTIS HC A09/MF A01

The dynamic method of satellite geodesy uses the numerical integration of the equations of motion to determine the temporal motion in relation to its reference orbit. A computer program REST is described which permits corrections to be performed for uncertainties introduced into the equations by the relief of the Earth and the elastic parameters of the Earth, Sun, and Moon. Author (ESA)

**N80-20704#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**STUDY FOR A PROJECT FOR A EUROPEAN HIGH PRECISION LASER NETWORK [PROJEKTSTUDIE FUER SATELLITEN-LASERNETZ HOECHSTER GENAUIGKEIT IN EUROPA]**

Walter Ehrnsperger and Martha Naebauer *In its* Res. Program 78, Satellite Geodesy Program 1978 p 139-158 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

Based upon simulated satellite transits of various heights, the attainable accuracy for a European network is investigated. The parameters are ranges as measured with third generation lasers or ranges in combination with optical directions. Numerical results for five stations and up to 100 satellite tracks are compared. Author (ESA)

**N80-20710#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**POSSIBILITIES OF APPLICATION OF LANDSAT AND SKYLAB DATA TO SMALL SCALE CARTOGRAPHY [VERWENDUNGSMOEGLICHKEITEN VON LANDSAT UND SKYLABAUFNAHMEN IN DER KLEIMASSTAEBIGEN KARTOGRAPHIES]**

Klaus Niemz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 85-140 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

The possibility of producing small scale topographic maps from the 70 mm film taken from Skylab and multispectral scanner data from LANDSAT is discussed. Maps with scales from 1:100,000 to 1:2,800,000 are considered. The production equipment is described. Author (ESA)

**N80-20722*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**[EARTH SURVEY APPLICATIONS DIVISION: RESEARCH LEADING TO THE EFFECTIVE USE OF SPACE TECHNOLOGY IN APPLICATIONS RELATING TO THE EARTH'S SURFACE AND INTERIOR]**

Nov. 1979 298 p refs ERTS

(E80-10084; NASA-TM-80550) Avail: NTIS HC A13/MF A01 CSCL 05B

**N80-20723*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**[EARTH SURVEY APPLICATIONS DIVISION: RESEARCH LEADING TO THE EFFECTIVE USE OF SPACE TECHNOLOGY IN APPLICATIONS RELATING TO THE EARTH'S SURFACE AND INTERIOR] Annual Report, 1979**

Lloyd Carpenter, ed. Jan. 1980 322 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E80-10087; NASA-TM-80642; AR-2) Avail: NTIS HC A14/MF A01 CSCL 05B

Accomplishments and future plans are described for the following areas: (1) geology - geobotanical indicators and geopotential data; (2) modeling magnetic fields; (3) modeling the structure, composition, and evolution of the Earth's crust; (4) global and regional motions of the Earth's crust and earthquake occurrence; (5) modeling geopotential from satellite tracking data; (6) modeling the Earth's gravity field; (7) global Earth dynamics; (8) sea surface topography, ocean dynamics; and geophysical interpretation; (9) land cover and land use; (10) physical and remote sensing attributes important in detecting, measuring, and monitoring agricultural crops; (11) prelaunch studies using LANDSAT D; (12) the multispectral linear array; (13) the aircraft linear array pushbroom radiometer; and (14) the spaceborne laser ranging system.

**N80-20726*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**MAGNETIC FIELD MODELING AND CRUSTAL STUDIES**

P. T. Taylor and G. D. Mead, Principal investigation *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 19-20 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20727*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**SPHERICAL HARMONIC MODELS OF THE CORE FIELD**

R. A. Langel, G. D. Mead, and R. H. Estes, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 21-29 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20728*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**CRUSTAL ANOMALY REPRESENTATION**

R. A. Langel, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 30-38 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20729*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**ANOMALY VERIFICATION: COMPARISON OF POGO MAGNETIC DATA WITH AEROMAGNETIC MEASUREMENTS**
P. T. Taylor, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 39-52 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20731*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REGIONAL MODELING: THE IVREA ZONE**
P. J. Wasilewski, M. A. Mayhew, and H. H. Thomas, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 61-62 refs ERTS
Avail: NTIS HC A14/MF A01 CSCL 08F

**N80-20741*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GSFC SITE STABILITY**
W. J. Webster, Jr. and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 98 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20742*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GEODETIC STABILITY OF THE GREEN BANK, WEST VIRGINIA VLBI SITE**
P. D. Lowman, W. J. Webster, Jr., and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 99-102 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20747*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GEODYN PROGRAM SYSTEMS DEVELOPMENT**
B. H. Putney, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 118-120 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08E

**N80-20748*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GRAVITY MODEL DEVELOPMENT**
F. J. Lerch, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 121-127 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08N

**N80-20749*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GRAVITY MODEL IMPROVEMENT FOR SEASAT**
F. J. Lerch, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 128-132 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20750*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE GRAVITY FIELD IN THE CENTRAL PACIFIC FROM SATELLITE-TO-SATELLITE TRACKING AND IMPLICATIONS FOR MANTLE CONVECTION**
J. G. Marsh, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 133-139 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
Avail: NTIS HC A14/MF A01 CSCL 08N

**N80-20751*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**UNEXPLAINED LAGEOS PERTURBATION**
D. P. Rubincam, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 140-144 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08N

**N80-20752*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MANTLE CONVECTION AND SUBCRUSTAL STRESS**
Han-Shou Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 146-147 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20753*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INFORMATION THEORY DENSITY DISTRIBUTION**
D. P. Rubincam, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 148-156 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20754*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE ENHANCED NODAL EQUILIBRIUM OCEAN TIDE AND POLAR MOTION**
B. V. Sanchez, Prinicpal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 157-164 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08H

**N80-20755*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**POLAR MOTION RESEARCH**
M. A. Graber, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 165-166 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08H

## 03 GEODESY AND CARTOGRAPHY

**N80-20756*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A DETERMINATION OF GM**
David E. Smith, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 167-170 ERTS
Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20757*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**POLAR MOTION AND EARTH ROTATION RESULTS FROM LAGEOS**
David E. Smith, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 171-173 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20758*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE SEASAT ALTIMETER HEIGHT BIAS USING FOUR BERMUDA OVERFLIGHTS**
R. Kolenkiewicz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 176-186 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 14B

**N80-20785*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE SPACEBORNE LASER RANGING SYSTEM**
W. D. Kahn, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 303-308 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 20E

# 04

# GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

**A80-21839** **Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation (Digitale Verarbeitung von Landsat-Daten über Eis- und Schneegebieten des Vatnajökulls /Island/ - Eine Möglichkeit verbesserter morphologischer tektonischer Interpretation).** U. Münzer and J. Bodechtel (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). *Bildmessung und Luftbildwesen,* vol. 48, Jan. 1, 1980, p. 21-28. 12 refs. In German.

Multitemporal Landsat scenes acquired over the Vatnajökull area in Iceland have been digitally enhanced. By applying simple enhancement techniques and linear combinations of MSS bands the known geotectonic pattern could be interpreted through the overlaying icecover. This referred especially to NE-SW and NW-SE striking lineaments and to ringstructures associated to subglacial volcanos. (Author)

**A80-22433** # **Some application of Landsat imagery interpretation for petroleum targetting in India.** D. Venkataramanan (Oil and Natural Gas Commission, Madras, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 911-923. 13 refs.

An assessment of the utility of space imageries in targeting for petroleum traps is presented. Interpretations of plotted lineaments in conjunction with geological, geomorphological, and geophysical data show that petroleum entrapment is more likely near the main boundary fault in the sub-Himalayan foothills which separate the fresh-water Siwalik sedimentary belt from the Pre-Tertiaries. It is concluded that in the southwestern West Bengal basin, a new geological model is proposed on imagery interpretation, and evidence is observed of the build-up in the basin of east-flowing rivers. A.T.

**A80-22435** # **An evaluation of parametric and nonparametric algorithms for unsupervised classification of surface disturbed lands.** P. W. Mausel, L. H. Alger, and P. J. Madison (Indiana State University, Terre Haute, Ind.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 939-949. 10 refs.

July, 1975 Landsat data acquired from coal strip mine lands in western Indiana were analyzed using parametric and nonparametric clustering algorithms. A parametric minimum Euclidean distance and two nonparametric multidimensional histogram-oriented cluster programs were used in an unsupervised classification mode to identify strip mine features. The cluster classes developed from each one of the processors provided information of potential value for monitoring coal strip mine features. This information can be especially useful between periods of more intensive analysis. All the cluster programs tested identified basic strip mine features such as ungraded spoil, graded spoil, strip mine water, and various categories of reclaimed land. However, the nonparametric approach to cluster analysis of large areas requires 4-20 times less CPU time than the minimum Euclidean distance processor. The cost characteristics of the nonparametric cluster program used at the Indiana State University Remote Sensing Laboratory (ISURSL) make it more economically feasible to use than parametric clustering techniques for acquiring important information from large coal strip mine areas. (Author)

**A80-22441** # **Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults.** R. Peterson (Nebraska, University, Lincoln, Neb.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 993-1014. 33 refs.

The system for exploration of oil and gas, described in the present paper, is based on the delineation of lineaments on remotely sensed images. By recognition of certain lineament patterns associated with bends in wrench faults, potential petroleum-bearing structures can be located. V.P.

**A80-22443** # **CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite.** M. Viellefosse and J.-C. Favard (Centre National d'Etudes Spatiales, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1025-1033. 9 refs.

The study of ground thermal behavior can give useful information about subsoil characteristics and soil moisture. Interest in this field has led to the definition of the CITHARE project, the aim of which is to determine the feasibility of elaborating significant products for geological and hydrological purposes. The basis for such a study is to use many successive IR and visible pictures in order to assess thermal inertia over a given area. For that reason a meteorological geosynchronous satellite, such as SMS, GOES or METEOSAT, with its high temporal and stable coverage appears as a first choice data source. (Author)

**A80-22458** # **Optimum Landsat sun angles for extreme contrasts of terrain.** C. A. Kitcho (Woodward-Clyde Consultants, San Francisco, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1213-1221. 12 refs.

Very low sun angles can hinder geologic interpretation of Landsat imagery because of the obscuring shadows caused by high relief contrast of terrain. Based on this observation during geologic interpretation of Landsat imagery of Alaska, this study was extended to include mountain ranges of various orientations and at different latitudes in the U.S. Optimum sun angles were derived, and guidelines for ordering correct Landsat images with minimal shadowing effect are presented. (Author)

**A80-22489** # **Application of Landsat in evaluation of selected earthquake prone areas.** R. S. Punongbayan, E. G. Ramos, J. B. R. Lim, E. S. Bate, E. S. Elefan, and D. R. Guerrero (Ministry of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1579-1590. 9 refs.

Preprocessing of Landsat scenes covering the Central Luzon Basin enhanced several lineaments believed to be alluvium-covered faults. The presence of these subsurface structural controls were evidenced by tonal variations, peculiar stream alignments and offsets, abrupt textural difference, and selective vegetation growths. The site is an extensive alluvium filled basin in northern Philippines. Its proximity to two earthquake-generating Benioff zones and the relative rarity of existing structural data within the basin, initiated re-analysis using Landsat MSS data. Preprocessing of the Landsat data such as band ratioing, transformation and contrast stretching were extensively used and the extracted lineament map was checked against cultural and structural data. This was coupled with earthquake recurrence maps to delineate areas where future surface dislocations may occur. (Author)

**A80-22491** # **The applicability of remote sensing technique for geological and mineral exploration in Nepal.** K. D. Bhattarai (Department of Mines and Geology, Kathmandu, Nepal). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1603-1608. 6 refs.

The applicability of remote sensing techniques for geological and mineralogical exploration in Nepal is discussed. Mineralization sites deduced from the fracture density contour map and lineament map are proposed, which include 182 sites from five regions, 18 of which are located around Katmandu. It is concluded that a possible relationship exists between linear features and drainage patterns. C.F.W.

**A80-22510** # **Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India.** N. Bedi (National Remote Sensing Agency, Secunderabad, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1861-1870. 10 refs.

**A80-25152** # **The role of navigation satellites in oil exploration.** J. G. Morgan (Chevron Geophysical Co., Houston, Tex.). In: Navigation satellite users; Proceedings of the National Aerospace Symposium, Springfield, Va., March 6-8, 1979. Washington, D.C., Institute of Navigation, 1979, p. 119-126. 9 refs.

The paper examines the requirements of the oil and gas exploration communities for navigation and positioning (with particular reference to seismic surveys, well site surveys, and drilling vessel positioning) and describes the role played by the Transit satellite system in oil and gas exploration. Emphasis is placed on some problems facing the civil user of Transit, particularly the problem of the time gap between some satellite fixes. B.J.

**A80-25159** # **GPS application to seismic oil exploration.** C. Johnson and P. Ward (Texas Instruments, Inc., Dallas, Tex.). In: Navigation satellite users; Proceedings of the National Aerospace Symposium, Springfield, Va., March 6-8, 1979. Washington, D.C., Institute of Navigation, 1979, p. 163-169.

The NAVSTAR Global Positioning System (GPS) is considered in terms of the requirements of the geophysical oil exploration industry. The suitability of the GPS for both marine and land surveys is discussed, as are receiver requirements in terms of C/A-code and P-code. It is noted that the space vehicles of the GPS provide a three-dimensional estimate of the user's position to 10 m and velocity to 0.01 m/s, as well as absolute GPS time to a few nanoseconds. J.P.B.

**A80-25577** **Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data.** L. H. Alger, P. W. Mausel (Indiana State University, Terre Haute, Ind.), and R. R. Herrer. In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 172-182. 9 refs.

The Indiana State University Remote Sensing Laboratory (ISURSL) has initiated a research program applied to evaluation of coal strip mine features in Indiana, Illinois, and Ohio using machine-assisted processing of Landsat MSS data. Specifically, two large strip mines in western Indiana were analyzed implementing both supervised and unsupervised non-parametric classification algorithms which were partially or totally developed at ISURSL. Nine classes of strip mine features were identified which included bare mine spoil, revegetated mine spoil, and water features in various physical states. An estimation of accuracy was made through comparison of the Landsat classification results with 1/30,000 scale aerial photographs taken the same day as the Landsat pass. Class accuracies ranged from 73% to 96% with an overall accuracy of 85%. The non-parametric approaches to classification used at ISURSL provide coal strip mine feature information of comparable quality to that generated by commonly used parametric classification systems, but they require as little as one-fourth the computer time for analysis. (Author)

**A80-26316** * **Remote sensing data of SP mountain and SP lava flow in north-central Arizona.** G. G. Schaber (U.S. Geological Survey, Branch of Astrogeologic Studies, Flagstaff, Ariz.), C. Elachi, and T. G. Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing of Environment,* vol. 9, Mar. 1980, p. 149-170. 21 refs. Contract No. NAS7-100. NASA Order W-08619; NASA Order W-13130.

Multifrequency airborne radar image data of SP Mountain and SP flow in north-central Arizona were obtained in diverse viewing directions and direct and cross-polarization and compared with surface and aerial photography, Landsat multispectral scanner data, airborne thermal infrared imagery, surface geology, and surface roughness statistics. The extremely blocky, basaltic andesite of SP flow is brighter on direct-polarization K-band images than on cross-polarized images taken simultaneously. This effect is explained by multiple scattering and the strong wavelength dependence of polarization effects caused by the rectilinear basaltic andesite scatters. Two distinct types of surface relief on SP flow, one extremely blocky, the other subdued, are clearly discriminated on the visible and thermal wavelength images but are separable only on the longer wavelength L-band radar image data. (Author)

**A80-26727** # **Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery (Izuchenie geologo-geofizicheskikh proiavlenii gorizontal'nykh napriazhenii v kore s pomoshch'iu kosmicheskikh snimkov).** G. Ia. Golizdra (Dnepropetrovskii Gornyi Institut, Dnepropetrovsk, Ukrainian SSR). *Geofizicheskii Sbornik,* no. 86, 1978, p. 83-88. 26 refs. In Russian.

Active longitudinal tectonic seams were detected in the region of the Don-Dnieper trough by analyzing small-scale satellite imagery. It is suggested that the asymmetric arrangement of the seams is due to long-time horizontal stresses directed from the south and the southwest. The tectonic-lines distribution is shown to be related to the structure of the Precambrian basement. The data obtained prove the importance of the greenstone belts in the crustal neotectonics. V.L.

**A80-27456** **An evaluation of landscape units.** V. B. Ackerson and E. B. Fish (Texas Tech University, Lubbock, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Mar. 1980, p. 347-358. 19 refs. U.S. Department of the Interior Contract No. CX702960143. DI Project B-206-TEX.

Land system delineation based on photographic image tone, texture, and pattern was investigated as a technique for obtaining land classification entities for the Guadalupe Mountains National Park of west Texas. It was shown that the boundaries of the delineated units were real in terms of slope, vegetative, and geologic variables. In addition, research indicates that the delineated landscape units are distinct entities which display a greater degree of internal homogeneity than would a series of randomly configured units of similar size; furthermore, homogeneity involved the physical and biological composition of sites as well as the number of sites. J.P.B.

**A80-32276** # **The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas (Primenenie raznomasshtabnykh mnogozonal'nykh kosmicheskikh snimkov zemli pri geologicheskom izuchenii neftegazonosnykh territorii).** S. V. Atanasian and V. D. Skariatin. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 115-122. In Russian.

The paper considers the application of photogeological interpretation methods to the exploration of areas with oil and natural gas reserves; the use of multispectral (including IR scanner) satellite photographs of different scales is examined. Geological interpretations of the Persian Gulf area and of the Caucasus Mountains area are considered as examples. B.J.

**A80-32277** # **Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region (Kompleksnoe geologicheskoe deshifrirovanie mnogozonal'nykh skanernykh snimkov raiona oz. Il'men').** V. D. Skariatin, V. B. Sokolova, and E. A. Shuleshkina. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 122-128. In Russian.

Landsat 1 photographs of the Ilmen Lake region, taken on June 4, 1973, are interpreted. A geological map of the region is presented, and structures of the foundation of the Ilmen lowland are examined. B.J.

**N80-16398*#** Geological Survey, Denver, Colo.
**GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Sep. - Nov. 1979**
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Nov. 1979 20 p Sponsored by NASA ERTS
(E80-10050; NASA-CR-162522) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-16410#** Department of Energy, Morgantown, W. Va. Energy Technology Center.
**GAS PRODUCTION OF DEVONIAN SHALE WELLS RELATIVE TO PHOTO LINEAMENT LOCATIONS: A STATISTICAL ANALYSIS**
J. F. Howard (Howard and Associates, Owensboro, Ky.), S. J. Lahoda (West Virginia Univ., Morgantown), W. E. Zirk (West Virginia Univ., Morgantown), and C. A. Komar Apr. 1979 19 p refs
(METC/CR-79/28) Avail: NTIS HC A02/MF A01

A pilot study was made to relate Devonian shale gas well production to distance from photo lineaments that were mapped at two different scales, namely low altitude (1:24,000) and intermediate altitude (1:62,500). Cumulative production after 5 years for 41 wells located in the Vicco quadrangle of Perry Co., Kentucky, was used in the study. A statistical two-way analysis of variance design was used to group the data into four classes depending on whether the producing wells were within or beyond 300 feet of a photo lineament derived from both scales. Results indicate that cumulative 5 year production is higher for wells sited within 300 feet of a low-altitude photo lineament. The correlations indicate a narrow zone of influence or effect for the geologic feature represented by the photo lineament. Moreover, the most consistently effective features are derived from low-altitude (1:24,000) scale photography, well below the detail commonly utilized in studies to date. DOE

**N80-16429#** Geological Survey, Reston, Va.
**U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: YELLOWSTONE NATIONAL PARK**
Janet Bonner 1979 117 p refs
(PB-301333/1) Avail: NTIS HC A06/MF A01 CSCL 08B

Computer listings of material available in photographic form showing scenes filmed by Skylab, LANDSAT, NASA aircraft, or on USGS mapping missions are presented. In the case of LANDSAT imagery, computer-compatible magnetic tapes are also available. A.R.H.

**N80-16430#** Geological Survey, Reston, Va.
**U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: ROCKY MOUNTAIN NATIONAL PARK**
Janet Bonner, comp. 1979 74 p
(PB-301334/9) Avail: NTIS HC A04/MF A01 CSCL 08B

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for chantes and trends in forest cover, water area, and other diagnostic landscape features. Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

**N80-16651*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PROCESSING OF MULTISPECTRAL THERMAL IR DATA FOR GEOLOGIC APPLICATIONS**
Anne B. Kahle, Daryl P. Madura, and James M. Soha 15 Nov. 1979 43 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-162682; JPL-PUB-79-89) Avail: NTIS HC A03/MF A01 CSCL 08G

Multispectral thermal IR data were acquired with a 24-channel scanner flown in an aircraft over the E. Tintic Utah mining district. These digital image data required extensive computer processing in order to put the information into a format useful for a geologic photointerpreter. Simple enhancement procedures were not sufficient to reveal the total information content because the data were highly correlated in all channels. The data were shown to be dominated by temperature variations across the scene, while the much more subtle spectral variations between the different rock types were of interest. The image processing techniques employed to analyze these data are described. J.M.S.

**N80-18516*#** Stanford Univ., Calif. Dept. of Geology.
**HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA**
Ernest I. Rich, Principal Investigator 21 Jan. 1980 2 p HCMM
(Contract NAS5-24479)
(E80-10067; NASA-CR-162588) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Detailed examination of Nite-IR images of intermontane basins in arid and/or semiarid areas of California discloses a ring or halo of relatively lighter greytone around the edges of each basin. Intermontane basins in the Northern Coast Range, however, do not show this thermal haloing. The topographic elevation of the haloes in arid basins shows seasonal variation, but it is present on nearly all images. A similar halo encircles many of the volcanoes on the Modoc Plateau and Southern Cascade Range. Although the halo around the arid intermontane basins can possibly be explained in relation to the location of alluvial fans (and perhaps water content of the rocks), a similar explanation cannot be made for the haloes around volcanoes or for the lack of haloes around basins in the Coast Range. Atmospheric thermal layering may be an alternative explanation; however, this explanation is also riddled with inconsistencies.

**N80-19603#** Wyoming Univ., Laramie. Dept. of Geology.
**VIDEO PROCESSING OF REMOTE SENSOR DATA APPLIED TO URANIUM EXPLORATION IN WYOMING Final Report**
Richard A. Levinson, Ronald W. Marrs, and Fred Crockett 30 Jun. 1979 223 p refs
(Contracts EY-76-C-13-1648; F(05-1)-1648)
(GJBX-171(79)) Avail: NTIS HC A10/MF A01

LANDSAT satellite imagery and aerial photography, used to map areas of altered sandstone associated with roll-front uranium deposits, must be enhanced so that alteration spectral contrasts can be seen. Video image processing is a fast, low-cost, and efficient tool. For LANDSAT data, the 7/4 ratio produces the best enhancement of altered sandstone. The 6/4 ratio is most effective for color infrared aerial photography. Samples from Pumpkin Buttes show that iron is the primary coloring agent which makes alteration visually detectable. Eh and pH changes associated with passage of a roll front cause oxidation of magnetic and pyrite to hematite, goethite, and limonite in the host sandstone, thereby producing the alteration. Statistical analysis show that the detectability of geochemical and color zonation in host sands is weakened by soil-forming processes. Alternation can only be mapped in areas of thin soil cover and moderate to sparse vegetative cover. DOE

**N80-20301#** Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
**SATELLITE CALIBRATION DATA, ANNUAL DATA REPORT Progress Report, Jan. - Dec. 1977**
L. I. Murillo and L. Edwin Williamson Aug. 1979 406 p
(DA Proj. 1L1-62111-AH-71)
(AD-A075602; ERADCOM/ASL-DR-79-0001) Avail: NTIS HC A18/MF A01 CSCL 22/2

This report contains data from observations of meteorological and radiative parameters at selected satellite calibration target sites. These sites include the highly reflective gypsum field in southcentral New Mexico, a dark lava surface, a nearby fresh water reservoir and over desert terrain. The report also contains narrative descriptions of the instruments in use at the target sites. GRA

**N80-20724*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**GEOBOTANICAL EXPLORATION**
M. Labovitz, E. Masuoka, and A. Siegrist, Principal Investigators *In its* Earth Survey Appl Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 2-4 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 06C

**N80-20725*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**GEOLOGICAL/GEOPHYSICAL RESOURCE ASSESSMENT**
R. C. Belcher, V. Gornitz, E. J. Masuoka, and K. T. Meehan, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 5-17 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08F

**N80-20730*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**REGIONAL MODELING: THE KENTUCKY ANOMALY**
M. A. Mayhew, H. H. Thomas, and P. J. Wasilewski, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to The Earth's Surface and Interior Jan 1980 p 54-60 ref ERTS
Avail: NTIS HC A14/MF A01 CSCL 08F

**N80-20732*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**INTERPRETATION OF GEOID ANOMALIES IN THE VICINITY OF SUBDUCTION ZONES**
D. C. McAdoo, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan 1980 p 63-67 refs ERTS
Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20733*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**GLOBAL GEOLOGY AND GEOPHYSICS USING SATELLITE-DERIVED DATA**
Herbert Frey, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 68-69 ref ERTS
11-43)
Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20734*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**GEOPHYSICAL ATLAS**
P. D. Lowman, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 70-72 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20735*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**COMPARATIVE PLANETOLOGY/CRUSTAL EVOLUTION**
Herbert Frey, Principal Investigator and P. D. Lowman, Jr. *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 73-74 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20736*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**CRUSTAL DEFORMATION: CRUSTAL DYNAMICS PROJECT**
H. Frey, R. J. Allenby, and P. D. Lowman, Jr., Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 77-80 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20737*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
**INVESTIGATION OF CRUSTAL DYNAMICS USING VLBI**
Chopo Ma and James W. Ryan, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan 1980 p 81-83 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20738*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
**CRUSTAL STRUCTURE AND DYNAMICS OF SOUTHEASTERN US**
R. J. Allenby and M. A. Mayhew, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 84-85 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20739*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
**PLATE BOUNDARY DEFORMATION IN CALIFORNIA**
P. D. Lowamn, Jr., Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 86-95 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20740*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
**ON THE SELECTION OF STATION SITES FOR OBSERVING STRAIN STREPS AND EARTHQUAKE FORERUNNERS IN CALIFORNIA**
H. S. Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl.

Relating to the Earth's Surface and Interior Jan. 1980 p 96-97 refs ERTS
Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20743*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EARTHQUAKE AND CRUSTAL DEFORMATION STUDIES**
S. C. Cohen, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 103-108 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20744*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**GLOBAL INTRA-PLATE VOLCANISM**
Han-Shou Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 109-110 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20745*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DEVELOPMENT OF A SEISMIC DATA COLLECTION PLATFORM**
W. J. Webster, Jr. and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 111-113 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20746*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CRUSTAL MOTION MEASUREMENTS IN CALIFORNIA (SAFE)**
D. E. Smith, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 114-115 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20764*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SURFACE MINE MONITORING**
J. R. Irons, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 213-215 ERTS
Avail: NTIS HC A14/MF A01 CSCL 08I

**N80-20787*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ASSESSMENT OF SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA FOR STRIP-MINE MONITORING**
Ernie W. Spisz and Joyce T. Dooley Washington Mar. 1980 39 p Original contains color illustrations
(NASA-TM-79268; E-187) Avail: NTIS HC A03/MF A01 CSCL 08I

The application of LANDSAT multispectral scanner data to describe the mining and reclamation changes of a hilltop surface coal mine in the rugged, mountainous area of eastern Kentucky is presented. Original single band satellite imagery, computer enhanced single band imagery, and computer classified imagery are presented for four different data sets in order to demonstrate the land cover changes that can be detected. Data obtained with an 11 band multispectral scanner on board a C-47 aircraft at an altitude of 3000 meters are also presented. Comparing the satellite data with color, infrared aerial photography, and ground survey data shows that significant changes in the disrupted area can be detected from LANDSAT band 5 satellite imagery for mines with more than 100 acres of disturbed area. However, band-ratio (bands 5/6) imagery provides greater contrast than single band imagery and can provide a qualitative level 1 classification of the land cover that may be useful for monitoring either the disturbed mining area or the revegetation progress. However, if a quantitative, accurate classification of the barren or revegetated classes is required, it is necessary to perform a detailed, four band computer classification of the data. J.M.S.

**N80-20803#** Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.
**COMPUTER PROCESSING OF MULTISPECTRAL SCANNER DATA OVER COAL STRIP MINES Final Report, 1 Jan. - 30 Jun. 1978**
Charles E. Tanner Mar. 1979 62 p refs
(Contract EPA-68-03-2636)
(PB80-111677; EPA-600/7-79-080) Avail: NTIS HC A04/MF A01 CSCL 08I

Aircraft multispectral scanner data acquired over six coal strip mines in the states of Wyoming, Montana, Colorado, and Arizona were processed on the Data Analysis System (DAS) using a clustering approach to automatic pattern recognition. The classification results demonstrated that a level one hierarchy of vegetation features, manmade features, and disturbed areas could be easily obtained with a minimum amount of time. GRA

**N80-21925#** National Technical Information Service, Springfield, Va.
**TECTONICS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Feb. 1980**
Audrey S. Hundemann Feb. 1980 273 p Supersedes NTIS/PS-79/0089; NTIS/PS-78/0082; NTIS/PS-77/0088
(PB80-804529; NTIS/PS-79/0089; NTIS/PS-78/0082; NTIS/PS-77/0088) Avail: NTIS HC $30.00/MF $30.00 CSCL 08G

Abstracts dealing with plate tectonics, remote sensing of terrain features, geologic faults, ocean bottom spreading, geomagnetic anomalies, paleomagnetism, and geomorphology are cited. This updated bibliography contains 266 abstracts, 28 of which are new entries to the previous edition. GRA

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## 05

# OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

**A80-21454** **Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data.** F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King (Research Triangle Institute, Research Triangle Park, N.C.). *Journal of Geophysical Research*, vol. 84, Dec. 20, 1979, p. 7749-7768. 21 refs. Contract No. EG-77-C-05-5444.

Satellite infrared data and in situ data were combined to study synoptic-scale and mesoscale fronts in the Gulf of Mexico in the period 1973-1977. Deep northward penetrations of the Loop Current were noted in the winter, and a major warm gyre developed in the winter, 1974. Other major warm gyres were seen to develop in the early spring (1974 and 1977). In all cases, a very large meander developed off the southern part of the west Florida shelf prior to the development of the major warm gyre. Smaller meanders were seen to move along the Loop Current boundary at an average speed of 28 km/day and with an average wavelength of 210 km. (Author)

**A80-21963** **The ocean observed with microwaves (El oceano observado con microondas).** C. Romeu Nedwed (Instituto de Investigaciones Pesqueras, Barcelona, Spain). *Ibérica*, vol. 57, Feb. 1979, p. 44-50. In Spanish.

Satellite microwave observation, is discussed, including active (radar) and passive (radiation) systems, microwave radiometers, and scatterometer teledetection. Although microwave systems allow day and night observation independent of meteorologic conditions, as well as 3-dimensional information, they suffer from low resolution and high cost. J.P.B.

**A80-22383** # **Remote sensing of ocean circulation using a satellite-borne radar altimeter.** B. C. Douglas and P. D. Gaborski (NOAA, National Ocean Survey, Rockville, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 81-91. 6 refs.

Altimeter data from collinear passes of GEOS-3 and Seasat satellites in the western Atlantic are reviewed, with particular attention given to the elimination of satellite ephemeris error and gravimetric geoids and other reference surfaces. It is found that, in general, repeated passes of satellite altimeter data provide a good means for investigating changes in the sea surface topography and hence the underlying circulation that produces the topography. In some areas where gravimetric data are plentiful a gravimetric geoid can be used directly as the reference surface. In addition, infrared observations of the ocean surface are an important source of data for the verification of features. B.J.

**A80-22384** # **The feasibility of measurement of ocean surface currents using synthetic aperture radar.** R. A. Shuchman, A. Klooster (Michigan, Environmental Research Institute, Ann Arbor, Mich.), C. L. Rufenach (NOAA, Wave Propagation Laboratory, Boulder, Colo.), and F. I. Gonzalez (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 93-102. 8 refs. Grant No. NOAA-A01-78-00-4822.

The paper discusses a technique which involves the measurement of ocean surface current velocity by the use of SAR Doppler signal history; radial (line of sight) velocities of currents shift the Doppler history, and it is this shift that is measured and exploited to obtain the horizontal current velocity. X- and L-band SAR data from near-shore and Gulf Stream ocean surfaces have been obtained on the basis of the Doppler shift of moving ocean scatterers relative to stationary scatterers. Currents deduced from these Doppler shift calculations were found to be consistent with available sea truth gathered during the Marineland Experiment. Furthermore, SAT-Seasat data of the Columbia River, Oregon is being evaluated to assess the potential of using SAR to map ocean surface currents. B.J.

**A80-22385** # **Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia.** J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada) and B. A. Hughes (Defence Research Establishment Pacific Esquimalt, British Columbia, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute, 1979, p. 103-115.

High resolution sea surface height and slope measuring equipment was deployed in the Gulf of Georgia, British Columbia, Canada, in the period July 12 to 30, 1978 at the times of SEASAT overpasses. In simultaneous overflights, the ERIM X and L band radar gave images, some of which showed extensive surface roughness modulation patterns caused by internal waves. This paper presents a comparison of the radiometric intensities observed on radar imagery with the measurements made along the ship's track and discusses the analysis techniques involved. (Author)

**A80-22406** # **Geostationary and orbiting satellites applied to remote ocean buoy data acquisition.** E. G. Kerut (NOAA, Data Buoy Office, Bay St. Louis, Miss.) and G. Haas (Sperry Rand Corp., Bay St. Louis, Miss.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 519-533. 17 refs.

The paper examines the need for evolutionary development and implementation of a global environmental measurement/monitoring system for the understanding and study of climate processes. It is noted that with the advent of geostationary and polar-orbiting satellites, the technology is now available to collect environmental data on a global basis from surface stations. It is shown that remote sensing of oceanographic and meteorological data by space-derived measurements will provide descriptions of planetary scale phenomena. In addition, moored and drifting buoy systems, in conjunction with space measurement systems, will enhance and complement the data products available from individual systems. M.E.P.

**A80-22410** # **Shallow-water reflectance modeling with applications to remote sensing of the ocean floor.** D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 583-602. 12 refs. Contract No. N00014-78-C-0458.

**A80-22411** # **Synthetic aperture radar modeling of surface ocean waves.** R. A. Shuchman, A. Klooster (Michigan, Environmental Research Institute, Ann Arbor, Mich.), and A. L. Maffett (Michigan, University, Dearborn, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2, Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 603-627. 20 refs. Contract No. N00014-76-C-1048.

The study draws together analytical and experimental results based on a combination of static and dynamic models explaining wave imagery obtained with a synthetic aperture radar (SAR). The observation of moving ocean, imaged by a SAR and studied in a SAR optical correlator supports a theory that the ocean surface appears relatively stationary in the absence of currents. The reflecting surface is most likely moving slowly (i.e., capillaries, wave, phase velocity, and orbital wave velocities) relative to the phase velocity of the large gravity waves. V.T.

**A80-22416 # Assessment of tidal wetland habitat and productivity.** D. S. Bartlett and V. Klemas (Delaware, University, Newark, Del.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 693-701. 19 refs.

The use of remote sensing in the quantitative assessment of wetland habitats is reviewed. Attention is given to the processes and difficulties associated with the spectral mapping of emergent plant species composition, the evaluation of plant biomass production, and problems associated with the use of aerial photography, radiometers and Landsat MSS data. It is concluded that remote sensing has established its utility in the delineation of wetland boundaries and the identification of species composition to infer tidal and salinity regimes and animal habitats. Further research on the spectral characteristics of wetlands and an improvement in the reliability and availability of atmospheric correction methodologies is needed, however, to enable the widespread spectral estimation of wetland biomass production. A.L.W.

**A80-22417 # A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances.** S. Tassan, B. Sturm, and E. Diana (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 713-727. 11 refs.

A specific feature of remote sensing of water bodies is the low value of typical water upwelling radiances. Only a minor part of the radiance measured by satellite or airborne sensors contains information about the water itself and substances in the water. The major part, originating from atmospheric scattering, as well as sun and sky glitter (in the following called atmospheric effects), must be determined and substracted from the total signal. This correction is, however, difficult to make with adequate accuracy. The paper reports the results from a sensitivity study of atmospheric effects on remote sensing of chlorophyll in water. (Author)

**A80-22418 # Remote sensing of living marine resources.** A. J. Kemmerer (NOAA, National Fisheries Engineering Laboratory, Bay St. Louis, Miss.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 729-738. 26 refs.

A review of direct and indirect forms of remote sensing for living marine resources is provided. Direct forms range from visual spotting of marine animals from aircraft to satellite tracking of individual animals, and monitoring of fishing activities. Four satellite investigations are reviewed which relied on indirect forms of remote sensing to infer distribution patterns of coastal fish and to infer surface circulation patterns for estimates of fish yields. Satellite systems emphasized include Landsat, Skylab, Nimbus-6, Seasat-A, and Tiros. (Author)

**A80-22434 # The use of models for predicting ice floes in Baffin Bay.** B. Dey and A. F. Gregory (Gregory Geoscience, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 933-937. 9 refs.

In this study, geometrically corrected and enlarged NOAA-VHRR images for July 1977 have been used for observing ice motion in Baffin Bay. The observed velocities and directions of forty-four ice floes were compared with predicted values from the existing model by Zubov (1943). Floe predictions with other models, such as Skiles and Neralla et al., are underway. The observed values of velocity and direction of ice floes show large deviations from predictions by Zubov's model. The deviation may result from several variables that affect the floe drift and which were not included in Zubov's model. (Author)

**A80-22447 # IR enhancement techniques to delineate surface temperature and sea-ice distributions.** K. Ahlnas (Alaska, University, Fairbanks, Alaska). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1067-1076. Contract No. NOAA-03-5-022-56.

The theories behind different types of enhancements, like the single scale, multiple scale and some modifications to obtain special identity, are explained with graphs and examples. To show the usefulness of various kinds of enhancements, some applications for special fields such as (1) water masses and coastlines, (2) oceanic eddies, and (3) sea ice are treated. Within each field specific cases are analyzed in detail. (Author)

**A80-22448 # Verification of synthetic aperture radar focusing algorithms on ocean waves.** E. S. Kasischke, A. Klooster, and R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1077-1092. 10 refs. Contract No. NOAA-7-35328.

A method is presented where radar backscatter signals from ocean waves can be measured and quantified (this methodology is referred to as modulation depth calculations). A brief discussion of the theoretical algorithms needed to correct for the velocity induced defocusing in SAR imagery of ocean waves is presented. A statistical analysis of modulation depth calculations showed X-Band (3.2 cm) data to be relatively insensitive to azimuth focusing attempts. The analysis showed L-band (23.5 cm) data to be sensitive to both azimuth and range focusing attempts. (Author)

**A80-22449 # Enhancement of Landsat imagery for the monitoring of coastal waters - Application to the southern part of the North Sea.** M. Viollier and N. Baussart (Lille I, Université, Villeneuve-d'Ascq, Nord, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1093-1105. 10 refs. Research supported by the Centre National de la Recherche Scientifique and Centre National d'Etudes Spatiales.

The paper examines how Landsat products have been improved by specific data processing, in order to monitor the quality of coastal waters. The methods of treatment covered are: (1) improvement of the signal-to-noise ratio, (2) atmospheric correction which takes into account Rayleigh scattering, and (3) the differences between the reflectances in MSS 5 and 6 bands. M.E.P.

**A80-22464 # Landsat bathymetric mapping by multitemporal processing.** F. C. Polcyn and D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *(Symposium on Measurement, Mapping, and Management in the Coastal Zone, New York, N.Y., May 21-23, 1979.)* In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1269-1276. 6 refs.

A recent test of modern methodology was made for selected portions of the Chagos Archipelago. A corrected chart of this area, based on photographic interpretation of Landsat-2 data, is presented, showing a new reef that was detected approximately 9 miles east of Speaker's Bank (named Colvocoresses Reef). Using techniques tested in the Bahamian Photobathymetric Calibration Range, computer depth charts were prepared, making use of basic physical parameters. V.P.

**A80-22466** # **Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries.** R. T. Biña and E. R. Ombac (Ministry of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1293-1308. 5 refs.

Effects of tidal fluctuation on the spectral characteristics of submerged reef areas were investigated through digital analysis of Landsat temporal images. Statistical comparisons and analyses were made on selected training areas as well as on different classification categories regarding differences in radiometric characteristics and area measurements. Results indicate the various spectral pattern changes in relation to tidal level variations. (Author)

**A80-22495** # **Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast.** R. Herz (São Paulo, Universidade; Conselho Nacional de Pesquisas, Instituto de Pesquisas Espaciais, São Paulo, Brazil). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1643-1656. 18 refs.

**A80-22496** # **Marine pollution analysis in Tokyo Bay by Landsat 1 and 2.** S.-I. Saitoh (Hokkaido University, Hakodate, Japan), J. Iisaka (IBM Japan, Ltd., Tokyo, Japan), and O. Asaoka (Meteorological Agency, Meteorological Research Institute, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1657-1679. 21 refs.

In the present study, marine pollution in Tokyo Bay has been analyzed by using multi-temporal Landsat MSS data from 1972 to 1976. Oceanographic conditions and pollution distributions were able to be interpreted by generating various kinds of imageries. Moreover, it was possible to determine quantitatively the change of marine pollution over a four year period by using chronological Landsat data in combination with other environmental information. As a result of this study, the recent report that marine pollution has improved since 1972 was supported. (Author)

**A80-22506** # **Remote sensing of the sea around Singapore.** Y. J. Chong, T. Y. Liang, A. C. Yeo, and V. K. Vong (University of Singapore, Singapore). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1807-1814. 9 refs.

Knowledge of the condition of the sea around Singapore is of great importance to Singapore. Remote sensing offers a synoptic view of a very large area and would be very useful in supplementing ground level studies. To determine the usefulness of remote sensing methods an analysis is carried out of Landsat multispectral scanner data on computer compatible tapes. The investigation covers areas in the coastal regions as well as in the open sea. Examples are given to show how Landsat imagery may be used to obtain information on changes in shoreline, dispersal patterns of pollution discharged by rivers, submerged coral reefs, and depth in clear shallow waters. (Author)

**A80-22941** * **Gulf stream ground truth project - Results of the NRL airborne sensors.** C. R. McClain (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, Md.; U.S. Navy, Naval Research Laboratory, Washington, D.C.), D. T. Chen, and D. L. Hammond (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Ocean Engineering*, vol. 7, no. 1, 1980, p. 55-97. 15 refs. NASA Order P-62257-G; NAVAIR Task A370/370C/058B.

Results of an airborne study of the waves in the Gulf Stream are presented. These results show that the active microwave sensors (high-flight radar and wind-wave radar) provide consistent and accurate estimates of significant wave height and surface wind speed, respectively. The correlation between the wave height measurements of the high-flight radar and a laser profilometer is excellent. (Author)

**A80-22942** * **Spectral distortion inherent in airborne profilometer measurements of ocean wave heights.** D. L. Hammond (U.S. Navy, Naval Research Laboratory, Washington, D.C.) and C. R. McClain (NASA, Goddard Space Flight Center, Sensor Development Branch, Greenbelt, Md.). *Ocean Engineering*, vol. 7, no. 1, 1980, p. 99-108. 13 refs. NASA Order P-62257-G; NAVAIR Task A370/370C/058B.

A theoretical analysis of the performance characteristics of an airborne profilometer is presented. The analytical characteristics are shown to agree with those of the prototype. Results show that both the wave spectra and the dominant wave heading can be determined using the airborne profilometer. (Author)

**A80-23286** **Spatial Gauss-Markov models of ocean currents.** S. K. Jordan (Geospace Systems Corp., Brookline, Mass.) and G. N. Sherman (Analytic Sciences Corp., Reading, Mass.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-15, Nov. 1979, p. 874-881. 18 refs.

Ocean currents are an important error source in marine inertial navigation systems (INS). Satellite radar altimeter data are used to construct self-consistent Gauss-Markov models of ocean currents. These models are useful for INS error analysis and optimal (Kalman) filtering of INS outputs. (Author)

**A80-24546** **Gulf stream ring trajectories.** P. L. Richardson. *Journal of Physical Oceanography*, vol. 10, Jan. 1980, p. 90-104. 21 refs. NSF Grants No. OCE-75-08765; No. OCE-76-82059; Contract No. N00014-74-C-0262. NR Project 083-004.

The movement of 2 anticyclonic and 12 cyclonic Gulf Stream (GS) rings was measured with satellite-tracked free-drifting buoys, revealing frequency strong interactions between rings and the GS. Rings that were not touching the Stream generally moved westward with typical speeds of 5 cm/s, and rings that were attached to the Stream generally moved downstream with speeds up to 75 cm/s. Frequently rings coalesced with the GS and either turned into open meanders, were advected downstream, or interacted with the GS, exchanged water and energy, and reformed as modified rings. J.P.B.

**A80-25153** # **Use of satellite navigation by tuna seiners.** J. D. Luse (Navigation Communication Systems, Inc., Chatsworth, Calif.) and L. Chicami. In: Navigation satellite users; Proceedings of the National Aerospace Symposium, Springfield, Va., March 6-8, 1979. Washington, D.C., Institute of Navigation, 1979, p. 127-132. 5 refs.

The paper deals with the use of satellite navigation by tuna purse-seiners. The satellite navigation equipment includes one NCS Model 2900N1 and one NCS Model 2800, both utilizing single-channel transit satellite tracking receivers and a microprocessor-based computer. It is noted that about 800 satellite navigation equipments are used in the tuna fleet for the following purposes: (1) enroute navigation, (2) searching for tuna schools, (3) returning precisely to logs or other locations, (4) estimating drift or current in fishing area, and (5) staying out of other countries' territorial waters. It is found that up to 2% of distance run can be saved by the use of satellite navigation. The other benefits include the determination of log positions with an accuracy of 0.5 miles or better, and the determination of set and drift with an accuracy of a few tenths of a knot. The use of satellite navigation equipment can result in cost reductions and/or increased production up to $120,000 per year. L.M.

## 05 OCEANOGRAPHY AND MARINE RESOURCES

**A80-25327** **Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978, Proceedings. Parts 1, 2 & 3.** Colloquium sponsored by the Inter Union Commission on Radio Meteorology. Edited by J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada). *Boundary-Layer Meteorology,* vol. 18, Feb.-May, 1980. Feb., 190 p.; Mar., 102 p.; May, 124 p.

Topics presented include passive radiometry of the ocean from space, atmospheric corrections to passive microwave observations of the ocean, and arctic sea-ice variation from time-lapse passive microwave imagery. Also discussed are oceanographic implications of features in NOAA satellite visible imagery, applications of a two-flow model for remote sensing of substances in water, and atmospheric effects in the remote sensing of phytoplankton pigments. C.F.W.

**A80-25328** **Passive radiometry of the ocean from space - An overview.** E. P. McClain (NOAA, National Environmental Satellite Service, Washington, D.C.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Feb. 1980, p. 7-24. 35 refs.

A brief description of unmanned earth-observation platforms in space, and their ocean-related radiometric instrumentation, is given. Both operational and research-type spacecraft, current and near-future, are discussed. Some recent oceanographic studies and applications are reviewed, including the following topics: sea surface temperature, sea ice, ocean surface roughness and near-surface wind, and ocean color. (Author)

**A80-25329 *** **Passive microwave remote sensing of the ocean - A review.** C. T. Swift (NASA, Langley Research Center, Hampton, Va.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Feb. 1980, p. 25-54. 29 refs.

This paper reviews the current status of passive microwave remote sensing of the ocean. The physics of emission and instrumentation are highlighted in order to establish a relationship between the thermal emission and retrieved geophysical parameters. A discussion then follows on measurements of temperature, salinity, windspeed, etc. using passive microwave systems. These measurements are related to the accuracy and spatial resolution required by the users. The status of passive microwave remote sensing is summarized and recommendations for future research are presented. (Author)

**A80-25330** **Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry.** A. E. Basharinov and A. M. Shutko (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Laver Meteorology,* vol. 18, Feb. 1980, p. 55-64. 15 refs.

**A80-25333 *** **Arctic sea-ice variations from time-lapse passive microwave imagery.** W. J. Campbell (U.S. Geological Survey, Reston, Va.), R. O. Ramseier (Department of the Environment, Ottawa, Canada), H. J. Zwally, and P. Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Feb. 1980, p. 99-106. 19 refs. NOAA-supported research.

This paper presents: (1) a short historical review of the passive microwave research on sea ice, which established the observational and theoretical base permitting the interpretation of the first passive microwave images of earth obtained by the Nimbus-5 ESMR; (2) the construction of a time-lapse motion picture film of a 16-month set of serial ESMR images to aid in the formidable data analysis task; and (3) a few of the most significant findings resulting from an early analysis of these data, using selected ESMR images to illustrate these findings. (Author)

**A80-25334** **The aqueous thermal boundary layer.** K. B. Katsaros (Washington, University, Seattle, Wash.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Feb. 1980, p. 107-127. 105 refs. Contract No. N00014-75-C-0502.

This article reviews the available data, measurement techniques, and present understanding of the millimeter thick aqueous thermal boundary layer. A temperature difference between the surface and lower strata of the order of a few tenths to -1 C have been observed. Techniques ranging from miniature mercury thermometers and electrical point sensors to optical interferometry and infrared radiometry have been employed. Many processes influence the temperature structure in this thin boundary layer. Among them are: the net upward heat flux due to evaporation and sensible heat transfer; infrared and solar radiation; and the turbulence near the interface due to wind mixing, wave breaking and current shear. Presence of solute and surface-active materials stimulate or dampen these mixing processes thereby influencing boundary-layer thickness and temperature structure. (Author)

**A80-25336** **Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations.** O. B. Brown and R. H. Evans (Miami, University, Coral Gables, Fla.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Mar. 1980, p. 145-157. 17 refs. NSF Grant No. OCD-73-00214; Contract No. N00014-75-00173.

**A80-25337** **Oceanographic implications of features in NOAA satellite visible imagery.** P. E. La Violette (U.S. Navy, Bay Saint Louis, Miss.), S. Peteherych (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada), and J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Mar. 1980, p. 159-175. 29 refs.

The paper examines the ocean-related samples of NOAA visible imagery and the geometric patterns in the infrared imagery. Data from the Grand Banks Experiment show that the sunglint features of this imagery are related to strong frontal processes in the area; although some features may be associated with fog or mist, the side-looking airborne radar imagery confirms the presence of surface roughness variations. The observations suggest that these roughness variations are due to changes in the stability of the atmospheric boundary layer caused by the different surface water temperatures in the area. A.T.

**A80-25338** **In-water and remote measurements of ocean color.** A. Morel (Laboratoire de Physique et Chimie Marines, Villefranche-sur-Mer, Alpes-Maritimes, France). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Mar. 1980, p. 177-201. 26 refs. Centre National d'Exploitation des Océans Contract No. 77/1695; Centre National de la Recherche Scientifique Contracts No. RCP-247; No. ERA-278.

The paper discusses the in-water and remote measurements of ocean color obtained from the spectral measurements of downwelling and upwelling irradiance above and below the surface. Typical results for water of various turbidities and phytoplankton content are presented; the magnitudes of the useful signal emerging from the water, and of the additional signals due to special reflection at the interface and to atmospheric scattering are compared on the basis of the spectroradiometric measurements performed within and above the sea from various altitudes. A.T.

**A80-25340** **Applications of a two-flow model for remote sensing of substances in water.** R. Doerffer (Hamburg, Universität, Hamburg, West Germany). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Mar. 1980, p. 221-232. 12 refs. Research supported by the Deutsche Forschungsgemeinschaft.

A two-flow radiative transfer model is presented for a study of the relationship between substances in water and the backscattered radiation field. It is shown that assuming a diffuse radiative input into a water body, the irradiance attenuation coefficient can be considered as an inherent property. A cuvette system is presented which can determine the attenuation coefficient, the absorption coefficient, and the backscattering coefficient of various substances. The model can check the applicability of a remote sensing technique for specific parameters; the inversion of the model can estimate concentrations in water from the backscattered radiation. A.T.

**A80-25342** **An algorithm for remote sensing of water color from space.** M. Viollier, D. Tanré, and P. Y. Deschamps (Lille I, Université, Villeneuve-d'Ascq, Nord, France). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, May 1980, p. 247-267. 21 refs. Research supported by the Centre National de la Recherche Scientifique and Centre National d'Etudes Spatiales.

The ocean color algorithm proposed in this paper takes into account the effects of Rayleigh and aerosol scattering. The inherent reflectance and the diffuse transmittance of the Rayleigh atmosphere are expressed as functions of optical thickness and satellite measurement geometry with the aid of simple and accurate formulas. In the case of a turbid atmosphere, from which the aerosol optical thickness is unknown, the aerosol contribution is estimated with the aid of a measurement in a channel where the ocean is a blackbody (in the red or near infrared). If the relationship between the ocean color and the chlorophyll-like pigment concentration is assumed to be known at sea level, it is shown that the chlorophyll-like pigment concentration at an open ocean site can be determined from space to within a factor of 1.5 to 3 (uncertainty equal to 0.2 to 0.5 log interval), depending on the atmospheric turbidity. (Author)

**A80-25343** **Gulf of Mexico, ocean-color surface-truth measurements.** R. W. Austin (California, University, La Jolla, Calif.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, May 1980, p. 269-285. 7 refs. Grant No. NOAA-04-6-158-44033.

In October 1977, a major remote sensing experiment was conducted in the Gulf of Mexico, in preparation for the launch of NIMBUS-7 which carried the Coastal Zone Color Scanner. Two major vessels obtained surface-truth measurements, while two jet aircraft at altitudes of 12.5 and 19.5 km obtained images of the surrounding ocean in 10 spectral bands. Measurements obtained in the surface water from the NOAA vessel Researcher of the spectral downwelling irradiances, upwelling radiances, attenuation and scattering properties are described. (Author)

**A80-25345 *** **Atmospheric effects in the remote sensing of phytoplankton pigments.** H. R. Gordon and D. K. Clark (NOAA, National Environment Satellite Service, Washington, D.C.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Mar. 1980, p. 299-313. 22 refs. Contract No. NAS5-22963.

The accuracy with which relevant atmospheric parameters must be estimated to derive photoplankton pigment concentrations of a given accuracy, from measurements of the ocean's apparent spectral radiance at satellite altitudes, is examined. A phytoplankton pigment algorithm is developed which relates the pigment concentration (c) to the three ratios of upwelling radiance just beneath the sea surface which can be formed from wavelengths (lambda) 440, 520 and 550 nm. C.F.W.

**A80-25346 *** **A design study for an advanced ocean color scanner system.** H. H. Kim, R. S. Fraser, L. L. Thompson (NASA, Goddard Space Flight Center, Greenbelt, Md.), and O. Bahethi (Science Applications and Systems, Inc., Lanham, Md.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Mar. 1980, p. 315-327. 10 refs.

Along with a colorimetric data analysis scheme, the instrumental parameters which need to be optimized in future spaceborne ocean color scanner systems are outlined. With regard to assessing atmospheric effects from ocean colorimetry, attention is given to computing size parameters of the aerosols in the atmosphere, total optical depth measurement, and the aerosol optical thickness. It is suggested that sensors based on the use of linear array technology will meet hardware objectives. J.P.B.

**A80-26751** # **Scales oceanic parameters as monitored from space.** K.-H. Szekielda (Hamburg, Universität, Hamburg, West Germany). *Remote Sensing Quarterly,* vol. 2, Jan. 1980, p. 16-35. 15 refs.

The development of spacecraft technology to monitor earth surface features has led to the application of remote sensing technology in oceanography to investigate the patchiness in the distribution of certain parameters. However, application over the oceans is restricted with regard to the size of the structures to be detected, their life span and the gradients created by concentration and temperature differences. For certain size scales, remote sensing from aircraft and remote sensing from satellites complement each other. Although finer structures can not yet be detected fully from satellite altitudes, larger oceanic systems from about 100-3000 km can be sufficiently monitored from space. (Author)

**A80-27331** **Field performance of a laser fluorosensor for the detection of oil spills.** R. A. O'Neil, L. Buja-Bijunas (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and D. M. Rayner (National Research Council, Ottawa, Canada). *Applied Optics,* vol. 19, Mar. 15, 1980, p. 863-870. 10 refs. Research supported by the Department of the Environment.

An airborne laser fluorosensor is described that was designed to detect and identify targets by means of the characteristic fluorescence emission spectrum. The first field trials of the sensor over marine oil and dye spills are reported. A correlation technique has been developed that, when applied to the data collected during these field trials, clearly differentiated among dye, the two crude oils, and the general fluorescence background of ocean water. (Author)

**A80-28251** **OCEANS '79; Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979.** Conference sponsored by the Institute of Electrical and Electronics Engineers and Marine Technology Society. New York, Institute of Electrical and Electronics Engineers, Inc., 1979. 815 p. $33.75.

Topics included in this work are on advanced surface craft, electromagnetic systems for ocean surface monitoring and communications, ocean energy, Space Shuttle support. Individual subjects such as the use of semi-submerged ships to support new technology at sea, buoyant module VHF antenna design for submerged systems/aircraft communications, a system for undersea storage of thermal energy, ocean wave concepts as well as the solid rocket booster dewatering set, and the SRB retrieval support craft are presented. C.F.W.

**A80-28256 *** **The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves.** D. D. Evans (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: OCEANS '79; Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 385-390. 23 refs. Contract No. NAS7-100.

The relationship between synthetic aperture radar (SAR) imagery of ocean waves and the ocean surface structure is discussed. The effects of ocean surface motion on SAR images is given. A generalization of conventional SAR correlation techniques is developed to provide imagery with the minimum possible degradation and distortion. The modeling of such imagery is discussed and an analytically tractable example given. Ongoing work towards the determination of the relevant components of surface microstructure is described. The future use of SAR phase information to supplement information obtainable from SAR imagery is suggested. (Author)

**A80-28263** **Field study of pollutant migration in the vicinity of a coastal front.** E. Waddell, J. Karpen, and P. Debrule (Science Applications, Inc., Raleigh, N.C.). In: OCEANS '79; Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 635-641. 9 refs. U.S. Bureau of Land Management Contract No. AA550-CT7-59.

Discharge of estuarine water onto the shelf can create plumes with limits defined by fronts. The associated density field can produce a circulation with flow toward the front and back down along a density interface. In a field study, surface and dispersed pollutant simulators were released in the vicinity of such a front and traced using aerial photographic techniques. Tracers tended to converge to the front at only a small portion (10%) of the front's migration velocity. Most fixed-frame tracer velocities resulted from tidal currents and plume growth. Wind effects caused divergence between aluminum chips and dyes. At times, wind shear moved aluminum across the front and against the convergent surface currents. When shear was weaker, aluminum accumulated on a moving front. Dyes were subducted along the density interface. Within the plume, vertical mixing and resultant dispersion were probably due to stronger vertical gradients in horizontal velocity than found in the ambient velocity field. Exchange between plume and ambient water was often inhibited by the strong stable pycnocline. (Author)

**A80-29389** **Remote sensing of ocean waters.** H. van der Piepen, V. Amann, R. Stätter, and M. Schroeder (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Optoelektronik, Oberpfaffenhofen, West Germany). In: Laser 79 opto-electronics; Proceedings of the Fourth Conference, Munich, West Germany, July 2-6, 1979. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1979, p. 508-513. 6 refs.

The remote sensing of ocean waters is examined with attention given to user requirements, the passive and active techniques currently in use, the incorporation of these techniques into major satellite projects, and the application of these techniques to the measurement of water parameters. Both optical and microwave methods are examined. B.J.

**A80-31989** **Analysis of remote sensing data in oceanography and climatology (Analyse des données de télédétection en océanographie et en climatologie).** J. M. Monget (Paris, Ecole Nationale Supérieure des Mines, Valbonne, Alpes-Maritimes, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 338-347. 6 refs. In French.

The digital processing of remotely sensed data for oceanographic and climatological applications is examined, using NOAA satellite VHRR sensor data as an example. Particular attention is given to the transformation of thermal IR images into sea-surface temperature maps. The advantages of multispectral scanners for climatological applications are emphasized. B.J.

**N80-18407*#** City Univ. of New York, N. Y. Inst. of Marine and Atmospheric Sciences.
**VERIFICATION PROCEDURES FOR THE SEASAT MEASUREMENTS OF THE VECTOR WIND WITH THE SASS**
Willard J. Pierson Jan. 1978 39 p refs Sponsored by NASA Prepared for JPL
(Contracts JPL-954411; N00014-77-C-0206)
(NASA-CR-162469; AD-A073644) Avail: NTIS HC A03/MF A01

Various relationships between the friction velocity and the roughness length in boundary layer models are studied in terms of the verification of the SASS on SEASAT. It is shown that verification against a measured wind at a known anemometer height is preferable to verification against a theoretical value of the friction velocity. The effect of the different models is small when they are used to refer all measured winds to one elevation. A model is proposed that has the features of two quite different models and the height of the anemometer for verification purposes is recommended to be 19.5 meters. GRA

**N80-18512*#** Department of Industry, London (England).
**SATELLITE MONITORING OF SEA SURFACE POLLUTION Progress Report, 1 Sep. - 31 Dec. 1979**
Gilbert Fielder and Duncan John Telfer, Principal Investigators 31 Dec. 1979 27 p Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10062; NASA-CR-162584; PR-2-14/P6; PR-2) Avail: NTIS HC A03/MF A01 CSCL 13B

The author has identified the following significant results. Image processing techniques developed are well adapted to the exploration and isolation of local areas which exhibit small temperature differences between themselves and their surroundings. In the worst case of imagery of small areal extent of sea surface having no coastal boundary in the area, there is yet no method of distinguishing unambiguously an oil spill from fog, cloud, the effect produced by shallow sediments, or the effects of naturally occuring thermal fronts. In the case of uniform slicks of liquid North Sea oil in still air, laboratory simulation experiments show that, for oil thicknesses in excess of 1 or 2 mm, there is, under equilibrium conditions, little dependence of oil surface temperature on the thickness of the oil layer. The surface temperature of oil is consistently higher than that of water, the difference being about 1 K at low values of relative humidity, but tending to increase as the relative humidity increases.

**N80-18542#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**BACKSCATTER MEASUREMENTS OF SEA ICE WITH A HELICOPTER BORNE SCATTEROMETER**
J. S. Patel, R. G. Onstott, C. V. Delker, and R. K. Moore Jul. 1979 132 p refs
(Contract N00014-76-C-1105)
(AD-A077614; RSL-TR-331-13) Avail: NTIS HC A07/MF A01 CSCL 08/12

The purpose of this paper is to describe the design and development of the University of Kansas helicopter-borne scatterometer system, HELOSCAT. The experiments performed to measure the radar backscatter from sea ice with this system along with the results are also described. Backscatter measurements were made at 1-2 GHz and 8-18 GHz frequencies, HH-polarization, and three incidence angles (20, 40, and 60 deg). Different types of ice ranging from thin ice to multiyear ice were observed; however, most data were collected from thick first-year and multiyear ice. A comparison of 1-2 GHz results for thick first-year and multiyear ice shows that the scattering coefficient values for multiyear ice at 60 deg are slightly lower than the value for thick first-year ice. The 8-18 GHz results show that the backscatter from multiyear ice at these frequencies is higher than the backscatter return from thick first-year ice by at least 3-4 dB. The frequency response of backscatter return is an upward sloping straight line on a dB-vs-frequency plot. For the multiyear ice, only the 60 deg data was found usable; the data at 20 deg and 40 deg were determined to be erroneous because of a malfunctioning frequency counter. GRA

**N80-18549*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**SEASAT GULF OF ALASKA WORKSHOP REPORT**

George H. Born (NOAA), John C. Wilkerson (NOAA), John W. Sherman, III, and David B. Lame May 1979 42 p Prepared in cooperation with DOD, Washington, D.C.
(NASA-CR-162463; PB-301417/2; JPL-662-101;
NOAA-79090406) Avail: NTIS HC A03/MF A01 CSCL 08J

Results are presented of an initial evaluation of part of the 105-day Seasat mission, focusing on data obtained from a 30 day experiment conducted in the Gulf of Alaska during August-September 1978. The Gulf of Alaska Seasat Experiment (GOASEX) was the only dedicated surface observation program conducted to validate the satellite data. Initial quantitative Seasat results produced during a Workshop held on January 22-26, 1979 are reported. Based on an early evaluation of these results, it is concluded that some of the original objectives of sensor performance were met. GRA

**N80-18671#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**COASTAL WATER TEMPERATURES IN THE SOUTHEASTERN PORTION OF BRAZIL FROM OCEANOGRAPHIC DATA AND NOAA SATELLITE OBSERVATIONS, VOLUME 1 [TEMPERATURAS DAS AGUAS DA COSTA SUDESTE DO BRASIL, OBTIDAS ATRAVES DE DADOS OCEANOGRAFICOS E DE DADOS DE SATELITES DA SERIE NOAA, VOLUME 1]**

Hector Manuel Inostroza Villagra and Jose Luiz Stech Sep. 1979 101 p refs In PORTUGUESE; ENGLISH abstract
(INPE-1569-RPE/070) Avail: NTIS HC A06/MF A01

Sub surface temperature charts in the southeastern coast of Brazil, utilizing oceanographic data and thermal sensor data of NOAA's satellites are presented. A detailed analysis of 350 oceanographic stations resulted in the finding of a marked seasonal tendency in the vertical temperature structure of the waters. A correlation was established between the surface and vertical thermal structure. The analysis was done on a weekly time basis with the year 1970 as the reference year. Temperature charts at the depth of 50 m were done for the four seasons of the year, as an example of the applicability of the model, with results considered as satisfactory in a first approach. M.M.M.

**N80-18673#** Smithsonian Astrophysical Observatory, Cambridge, Mass.

**STUDY OF OCEANIC LITHOSPHERE USING GEOS-3 RADAR ALTIMETER DATA Final Report, 1 Oct. 1977 - 30 Sep. 1979**

M. C. Roufosse Jul. 1979 29 p refs
(Contract F19628-78-C-0003; AF Proj. 2309)
(AD-A077344; AFGL-TR-79-0181) Avail: NTIS
HC A03/MF A01 CSCL 08/7

The aim of this work is to study the mechanical properties and time evolution of the lithosphere. For that purpose, geoid heights derived from the Geos 3 radar altimeter were used. The study of the correlation existing between bathymetry and free-air anomalies or geoid heights gives information on the mechanical properties of the lithosphere and its thickness. The lithospheric thickness is related to the age of the lithospheric plate, and by probing several locations spanning varied temporal situations, one is able to retrace the time evolution of the lithospheric plates. Toward that aim, several seamount chains, islands, and ridges have been investigated in the Pacific, Atlantic, and Indian Oceans. In the regions studied so far, the age of the lithosphere at the time of loading is the primary parameter. In this work, the author attempts a systematic study of all the parameters influencing the observed mechanical properties of the lithosphere. GRA

**N80-18678#** Research Inst. of National Defence, Stockholm (Sweden).

**TESTS OF LASER INDUCED FLUORESCENCE FROM ALGAE AT SEA [LASERINDUCERAD FLUORESCENS FRAAN ALGER. RESULTAT FRAAN ETT BAATBURET FAELTFOERSOEK]**

Brit Hartmann, Ove Steinvall, and Anders Widen Jul. 1979 52 p refs In SWEDISH
(FOA-C-30171-E1) Avail: NTIS HC A04/MF A01

Fluorescence from algae illuminated by a boat mounted laser was measured to see if the technique is feasible for airborne ocean surveillance of algae concentrations and oil or chemical spills. Good agreement was found between the laser data and manually gathered data, but uncertainty about chlorophyll concentrations requires that the airborne system be complemented with a ground truth calculation method in some parts of the area surveyed. Author (ESA)

**N80-19332*#** Naval Research Lab., Washington, D. C.

**A UNIQUE RADIO OCEANOGRAPHIC RADAR Final Report**

James E. Kenney (NASA. Langley Research Center) and Edward J. Walsh (NASA. Wallops Station) Nov. 1979 24 p
(Contract NASA Order L-17098-A)
(AD-A077364; NRL-MR-4086) Avail: NTIS
HC A02/MF A01 CSCL 17/9

A 36 GHz computer controlled airborne radar has been developed by NRL and NASA WFC which generates a false-color coded elevation map of the sea surface below the aircraft in realtime and can routinely produce ocean directional wave spectra with off-line data processing. GRA

**N80-19586*#** Lille Univ. (France).

**SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE. HEAT CAPACITY MAPPING MISSION (HCMM) Progress Report**

P. Y. Deschamps, R. Frouin, G Cassanet, and F. Verger, Principal Investigators Dec. 1979 53 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20711. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10057; NASA-CR-162753; PR-2) Avail: NTIS
HC A04/MF A01 CSCL 08C

The author has identified the following significant results. HCMM data analysis shows some mesoscale features which were previously expected to occur: summer coastal upwellings in the Gulf of Lions, tidal fronts bordering the English Channel, and cooler surface waters at the continental shelf break. The analysis of the spectral variance density spectra show that the interpretation of the data usually is limited by the HCMM radiometric performance (noise levels) at wavenumbers below 5 km in the oceanic areas; from this analysis it may also be concluded that a decrease of the radiometric noise level down to 0.1 k against an increase of the ground resolution up to 2 km would give a better optimum of the radiometric performances in the oceanic areas. HCMM data appear to be useful for analysis of the sea surface temperature field, particularly in the very coastal area by profiting from the ground resolution of 500 m.

**N80-20760*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.

**MEAN SEA SURFACE COMPUTATION USING GEOS-3 ALTIMETER DATA**

J. G. Marsh, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 190-197 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08C

**N80-20761*#** National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.

**OCEAN CIRCULATION**

R. E. Cheney, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 198-202 refs ERTS
11-43)
Avail: NTIS HC A14/MF A01 CSCL 08C

**N80-20762*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**STARLETTE ORBIT ANALYSES FOR OCEAN TIDAL STUDIES**
T. L. Felsentreger and J. G. Marsh, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 203-206 refs ERTS

**N80-20786#** Electrotechnical Lab., Ibaraki (Japan).
**MICROWAVE REMOTE SENSING TECHNOLOGY FOR THE MARINE OIL POLLUTION SURVEILLANCE**
Toshio Nenoto, Ichiro Yokoshima, Yoshihiko Kato, Takehiko Hidaka, Yutaka Kurioka, Minoru Yokota, Shinobu Hashimoto, Hiroshi Nakano, and Masahiko Yamaguchi Aug. 1979 166 p refs In JAPANESE; ENGLISH summary
(Rept-202) Avail: NTIS HC A08/MF A01

The existing state of oil pollution in the adjacent seas of the Japanese Archipelago, the techniques used in the oil detection and monitoring, and technical problems to be met in carrying out the patrol mission concerned with the enforcement of marine environment protection law are outlined. Functional requirements of a practical surveillance system useful for facilitating the activities to prevent the marine oil pollution are given. Basic mechanisms of interactions of microwaves at the air-sea water and air-oil-sea water interfaces are described. Reflection coefficients and emissivities of clean sea and polluted sea are exemplified under a number of different conditions of the temperature and salinity of sea water, observing frequency, and polarization of electromagnetic wave. The mechanisms of interaction between microwave signals and the atmospheric component gases and water droplets of various sizes are described, and examples of parameters useful for calculations of practical atmospheric attenuation and emission of microwaves are given. J.M.S.

**N80-20790#** Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Remote Sensing Branch.
**INTERACTIVE DIGITAL SATELLITE IMAGE PROCESSING SYSTEM FOR OCEANOGRAPHIC APPLICATIONS Final Report**
Albert E. Pressman and Ronald J. Holyer Apr. 1978 18 p
(AD-A079697; NORDA-TN-23) Avail: NTIS HC A02/MF A01 CSCL 08/10

The NORDA oceanographic satellite remote sensing program will emphasize data exploitation as opposed to data collection. This emphasis is because the collection technology has already far outstripped our ability to utilize the data for oceanographic purposes. The satellite data system described herein is an essential component for development and demonstration of processing, analysis, and interpretation methodology. The NORDA system includes a near real-time capability to receive GOES and limited VHRR data for screening purposes. GRA

**N80-21010#** National Ocean Survey, Rockville, Md. Test and Evaluation Lab.
**WAVE SENSOR SURVEY**
Richard L. Ribe Jul. 1979 48 p
(PB80-118581; NOAA-TR-NOS-78; NOAA-79101102) Avail: NTIS HC A03/MF A01 CSCL 08C

A study of selected scientific and engineering literature was conducted to survey the state-of-the-art of wave measurement technology. Brief descriptions of representative wave sensors and their principles of operation are given. GRA

**N80-21406#** British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
**COASTAL OCEANS MONITORING SATELLITE SYSTEM (COMSS). VOLUME 1: EXECUTIVE SUMMARY Final Report**
Mar. 1979 81 p Prepared in cooperation with Engins Matra Velizy, France; Technical Univ. of Denmark, Copenhagen; Logica Ltd. and Sira Inst. Ltd. Original contains color illustrations
(Contract ESA-3632/78-F-CG)
(ESS/SS-930; ESA-CR(P)-1281) Avail: NTIS HC A05/MF A01

A study of the major systems aspects associated with the Coastal Ocean Monitoring Satellite System (COMSS) and design studies of principal payload elements in the space segment are presented. The COMSS concept envisages a large 3-axis stabilized satellite incorporating several Earth observation sensors operating in the visible, infrared, and microwave regions of the spectrum. This satellite and the system of which it forms a part would be used for monitoring the economically and environmentally important coastal oceans regions of Europe and the World. Author (ESA)

**N80-21819#** European Space Agency, Paris (France).
**SEA SURFACE TEMPERATURE ANOMALY MAPPING USING THE NOAA SATELLITES**
M. Albuisson (Ecole des Mines, Valbonne, France), J. M. Monget (Ecole des Mines Valbonne, France), and G. Nihous (Ecole des Mines, Valbonne, France) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 201-204 refs Sponsored by Centre Natl. d'Eploitation des Oceans

Avail: NTIS HC A12/MF A01

A method for processing NOAA very high resolution radiometers data is described. The method eliminates various types of noise and produces surface temperature maps with an accuracy suitable for oceanographic applications. An example of a climatology study based on data gathered from 1975 to 1978 on the Ligurian Sea is presented. Author (ESA)

**N80-21820#** Institute of Oceanographic Sciences, Wormley (England).
**MONITORING THE SEA SURFACE**
T. D. Allan *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 205-215

Avail: NTIS HC A12/MF A01

The application of current satellite technology to the scientific study of the oceans is reviewed with emphasis on the performance of the microwave sensors carried on Seasat-1. A brief resume of the future plans of NASA and ESA in the field of oceanographic satellite is provided. Author (ESA)

**N80-21821#** Joint Research Centre of the European Communities, Ispra (Italy).
**BIOLOGICAL APPLICATIONS INCLUDING POLLUTION MONITORING**
B. Sturn *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 217-222 refs

Avail: NTIS HC A12/MF A01

The coastal zone color scanner (CZCS) on board the Nimbus-7 satellite is described. The CZCS measures upwelling spectral radiances from the ocean in five visible and one thermal IR band. The use of the CZCS to determine chlorophyll-a concentrations in the water is discussed. Author (ESA)

# 06

# HYDROLOGY AND WATER MANAGEMENT

**Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.**

**A80-22398** # **Impacts of land use on estuarine water quality.** J. M. Hill (Louisiana State University, Baton Rouge, La.) and K. Stout (Trident Engineering Associates, Inc., Warrenton, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 385-395. 13 refs.

The paper stresses the need for establishment of a large scale coastal monitoring and management program, noting that such a program cannot be accomplished under present traditional sampling procedures and current funding and staffing levels. Attention is given to the application of existing remote sensing techniques (both aircraft and satellite), by the Environmental Protection Agency, to monitoring and management schemes in the nation's coastal zone. Emphasis is placed on the use of remotely acquired data to help establish land-use/water quality relationships in estuarine systems. M.E.P.

**A80-22399** # **A laser-fluorosensor technique for water quality assessment.** M. Bristow, D. Nielsen, and R. Furtek (U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nev.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 397-417. 26 refs.

A profiling airborne laser-fluorosensor has been used to monitor changes in surface water chlorophyll a fluorescence for concentrations down to 1 microgram/liter at a minimum aircraft elevation of 200 m above the water surface under clear-sky day-light conditions. Sensitivity of the original system is about 0.4 microgram/liter with a minimum signal-to-background noise ratio of 3. With implementation of measures to increase the laser peak power and reduce the background signal and noise, detection of chlorophyll a levels will be possible down to 0.1 microgram/liter with a minimum signal-to-background noise ratio of 20. Comparisons between chlorophyll a ground truth data and the airborne chlorophyll a fluorescence signal produced linear correlation coefficients in the range from 0.77 to 0.95. (Author)

**A80-22451** # **Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan.** J. G. Lyon (Michigan, University, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1117-1129. 12 refs. Grant No. NOAA-04-8-M01-134.

Two approaches to wetland quantity and quality analysis were examined. In the first approach, the coastal wetlands of the St. Clair River delta were delineated with aerial photography, and described with two wetland classification systems. The second approach examined the capability of computer classification of Landsat digital data to provide coastal land use and vegetation community information. The value of these approaches for wetland inventory and utility of the classifications is addressed. (Author)

**A80-22454** # **Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing.** F. Becker, D. Blumenroeder, E. Hechinger, A. Hourani, B. Ramey, J. Trautmann (Strasbourg I, Université, Strasbourg, France), C. Dechambenoy, and A. Pellegrin (Ecole Polytechnique, Palaiseau, Essonne, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1151-1166. Research supported by the Centre National d'Etudes Spatiales, Delegation Générale à la Recherche Scientifique et Technique, and Electricité de France.

An airborne remote measurement of the surface temperature of the Rhine has been performed in the 10.5-12.5 micron window with the French 4-channel scanning radiometer ARIES which gives well calibrated digitized radiometric temperatures of the ground due to accurate calibrations performed both during the flight and at the laboratory. Using a simple, fast, approximative radiative transfer model, it has been possible to correct the radiometric data to obtain, with the LAE 980 image processing system of the laboratory, encoded coloured images of the absolute surface temperature with an error less than or equal to 0.4 C. A mapping of these images has been made on a topographic map allowing comparisons of the surface temperature at different times and seasons in order to monitor the thermal pollution, as well as the dynamics of the water flows or its interaction with the underground water table. This procedure has been employed successfully over the Atlantic Ocean and the Mediterranean Sea. (Author)

**A80-22461** # **On the penetration of microwaves in snow and soil.** C. Matzler, R. Hofer, D. Wyssen, and E. Schanda (Bern, Universität, Berne, Switzerland). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1243-1249.

The potentiality of relating classical ground truth data to microwave signature for remote sensing purposes depends very critically on the penetration depth, p. The paper reports on the measurement of p by passive microwave remote sensing in the 1.8 to 94 GHz range. The method is applied to soil and snow. In order to estimate the uncertainty of p due to the model dependence the results of two extreme situations are compared, the results of which vary by less than a factor 2. The penetration depth of a humid loam soil was found to decrease from about 5 cm at 1.8 GHz to 1.5 cm at 36 GHz. On the other hand the penetration depth of snow was found to change drastically, according to the content of liquid water. (Author)

**A80-22467** * # **The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah.** C. J. Merry (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1309-1316. 7 refs. Grant No. NsG-5014.

A water sampling program was accomplished at Lake Powell, Utah, during June 1975 for correlation to multispectral data obtained with a 500-channel airborne spectroradiometer. Field measurements were taken of percentage of light transmittance, surface temperature, pH and Secchi disk depth. Percentage of light transmittance was also measured in the laboratory for the water samples. Analyses of electron micrographs and suspended sediment concentration data for four water samples located at Hite Bridge, Mile 168, Mile 150 and Bullfrog Bay indicated differences in the composition and concentration of the particulate matter. Airborne spectroradiometer multispectral data were analyzed for the four sampling locations. The results showed that: (1) as the percentage of light transmittance of the water samples decreased, the reflected radiance increased; and (2) as the suspended sediment concentration (mg/l) increased, the reflected radiance increased in the 1-80 mg/l range. In conclusion, valuable qualitative information was obtained on surface turbidity for the Lake Powell water spectra. Also, the reflected radiance measured at a wavelength of 0.58 micron was directly correlated to the suspended sediment concentration. (Author)

**A80-22470 * #** **A regression technique for evaluation and quantification for water quality parameters from remote sensing data.** C. H. Whitlock (NASA, Langley Research Center, Marine Environments Branch, Hampton, Va.) and C. Y. Kuo (Old Dominion University, Norfolk, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1351-1365. 19 refs.

The paper attempts to define optical physics and/or environmental conditions under which the linear multiple-regression should be applicable. It is reported that investigation of the signal response shows that the exact solution for a number of optical physics conditions is of the same form as a linearized multiple-regression equation, even if nonlinear contributions from surface reflections, atmospheric constituents, or other water pollutants are included. Limitations on achieving this type of solution are defined. Laboratory data are used to demonstrate that the technique is applicable to water mixtures which contain constituents with both linear and nonlinear radiance gradients. Finally, it is concluded that instrument noise, ground-truth placement, and time lapse between remote sensor overpass and water sample operations are serious barriers to successful use of the technique. M.E.P.

**A80-22478 #** **Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information.** N. Marlenko (Comisión Nacional de Investigación del Espacio, Buenos Aires, Argentina). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1455-1463.

**A80-22490 * #** **Remote sensing analysis of water quality in the San Francisco Bay-delta.** S. Khorram (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1591-1601. 15 refs. Research supported by the University of California; Grant No. NsG-5256.

Water quality parameters in the San Francisco Bay-delta area using remotely sensed data combined with in situ data are investigated. The parameters included suspended solids, chlorophyll, turbidity, and electrical conductivity; the ocean color scanner (OCS) data were acquired from a NASA U-2 aircraft, and water quality samples were obtained from boats. It was concluded that areas with high biological activity were clearly discernible on enhanced imagery from OCS data, and it was impossible to locate such areas on aerial photography taken with conventional or infrared sensitive color films. A.T.

**A80-24054** **Remote sensing and water resources in Quebec (Télédétection et ressources en eau au Québec).** G. Rochon (Université Laval, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 33-42. 12 refs. In French.

The applicability of remote sensing activities to the management of water resources in Quebec is reviewed. The ways in which remote sensing can be applied to the localization of water, measurement of its motions and physicochemical characteristics, and the determination of its relationships with the terrestrial ecosystem in Quebec are examined, and the possible roles of remote sensing in the monitoring of changes in lake or marine environments are indicated. The management of water resource information in Quebec and Canada as a whole is discussed, and it is suggested that environmental data be allowed to circulate to all concerned provincial and local agencies in order to achieve the full potential of remote sensing and other forms of water resource investigations. A.L.W.

**A80-24058** **A comparative study of various remote sensing techniques applied to geomorphology (Etude comparée de différentes techniques de télédétection appliquées à la géomorphologie).** P. Clément and F. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 85-96. 7 refs. In French.

Remote sensing imagery of the Eaton river basin in Quebec obtained in the visible, near-infrared, and thermal-infrared ranges and by synthetic aperture radar is compared. Color infrared is shown to be the most appropriate technique for identifying mineral deposits, although daytime thermal imagery may reveal deposit boundaries if they are accompanied by modifications in drainage patterns. L-band synthetic aperture radar with HH polarization is found to be capable of localizing lines of rock outcroppings and tectonic accidents, along with daytime thermal, while erosion channels under wooded areas can be visualized using X-band synthetic aperture radar with HV polarization. It is concluded, however, that conventional photointerpretation of remote sensing data provides information superior to that obtained by panchromatic stereophotography only in a few instances, and further work in determining the relationships between geomorphological parameters and the properties measured by remote sensing techniques is necessary. A.L.W.

**A80-24059** **Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis.** A. Ichikawa, N. Tamai (Tokyo, University, Tokyo, Japan), H. Kanda (Ministry of Construction, River Environmental Div., Kawasaki, Japan), and S. Tanaka (Remote Sensing Technology Center of Japan, Tokyo, Japan). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 101-118. 11 refs.

An aerial MSS study of the water quality under typical hydraulic conditions of the Tama River in the Tokyo metropolitan area is presented. Data were obtained by an airborne digital multispectral scanner at an altitude of 1000 m with a resolution of 2 m during winter and summer, and processed using multispectral image analyzers. The production of false-color images allows the identification of bars, flood plains, falls, pools, confluences of tributaries, sewage effluent outfalls, and pollutant mixing zones in eight color slices, which are confirmed by ground truth data. From this two-dimensional display, river hydrodynamics are investigated, with the use of isotherms and isoconcentration contours, and self-purification coefficients are derived which suggest that purification is intensified by settling in the backwater zone of weirs. It is concluded that, although the application of remote sensing to hydro-environmental problems has been shown to be worthwhile, detailed and precise quantitative investigation is necessary for deriving pollution control strategies. A.L.W.

**A80-24060** **The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources (Mesure des variations horaires de température et de l'albédo terrestre par satellite - Application à la télédétection des ressources en eau).** M. Vieillefosse and J.-C. Favard (Centre National d'Etudes Spatiales, Toulouse, France). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 119-128. In French.

The use of satellite observations of the visible reflectance of the earth and its thermal emission in order to determine soil moisture is discussed. It is shown that geostationary or polar orbiting satellites such as SMS, Meteosat and HCMM can measure hourly or semidiurnal changes in temperature and albedo and thus determine the thermal inertia of the surface, a function of its moisture content. Measurements of the terrestrial radiation balance are also presented as a promising means of determining the moisture content of soils covered by vegetation and evapotranspiration through them. A.L.W.

**A80-24061** **Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images (Remplissage du réservoir de LG 2 - Surveillance à l'aide des images Landsat).** P. Laframboise (Société de Développement de la Baie James, Canada), A. Bachand (Société d'Energie de la Baie James, Montreal, Canada), and H. Audet (Ministère des Terres et Forêts, Centre Québécois de Coordination en Télédétection, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 129-133. In French.

Landsat images used for the surveillance of the LG 2 reservoir in France during the filling-up period, as part of a global ecological surveillance program, are considered. Also discussed are observations of the ice-covered period, the ice break-up and rising of the water, and periods of mixing (sediment and suspended organic material, water dynamics, floating bogs), and stratification. J.P.B.

**A80-24827** **Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region.** R. Hofer and C. Mätzler (Bern, Universität, Berne, Switzerland). *Journal of Geophysical Research*, vol. 85, Jan. 20, 1980, p. 453-460. 30 refs.

A report on a 2-year period of monitoring parameters of a natural snowpack by ground-based microwave radiometry on a high-altitude Alpine test site is presented. The microwave brightness temperatures are compared to a large set of ground-truth data. Three stages in the seasonal development of the snow cover are easily distinguishable which allow the prediction of the beginning of the snow melting. The moisture content of the melting surface layer is estimated by the aid of the typical daily variations of microwave brightness temperatures in spring. The test site was composed of two snow fields. The first one was lying on slightly reflecting soil, and the second one was lying on a completely reflecting metal foil. By measuring on both fields some microwave snow parameters can be determined. The damping coefficients for microwaves between 5 and 100 GHz were estimated by comparing the results of two extreme theories. Both theories gave results from less than 1 dB/m to more than 30 dB/m depending on the snow state, especially its liquid water content. (Author)

**A80-26787** **An assessment of electromagnetic remote sensing systems for the detection of perched water tables.** L. Tinney, C. E. Ezra, and J. E. Estes (California, University, Santa Barbara, Calif.). In: EASCON '79; Electronics and Aerospace Systems Conference, Arlington, Va., October 9-11, 1979, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 87-96. 37 refs.

Research efforts conducted by the Geography Remote Sensing Unit (GRSU) have investigated the study of multispectral capabilities for detecting surface soil moisture as related to the presence of shallow or 'perched' water tables at a southern San Joaquin Valley, California test site. This study focuses upon remote sensing techniques within the spectral range 0.4 micron and 23 cm of the electromagnetic spectrum. Basic physics and components of remote sensing systems applicable to the detection of shallow perched water tables for the sensor systems operating within this spectral region are presented in this study. Additionally, imagery from the visible and reflective infrared (aerial camera and Landsat scanner), thermal infrared (aircraft scanner) and microwave (both active L-band and passive 35 GHz micrad) are analyzed to determine their respective utilities and limitation in detecting perched water table regions. (Author)

**A80-27431 *** **Wetland flow resistance determination using Landsat data.** J. C. Gervin (NASA, Goddard Space Flight Center, Eastern Regional Remote Sensing Applications Center, Greenbelt, Md.) and S. F. Shih (Florida, University, Belle Glade, Fla.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 105-116. 9 refs. NASA-supported research.

In the past, one value of the roughness coefficient has frequently been used to represent the flow resistance characteristics of an entire natural wetland throughout the year. To improve the simulation of water flow through these natural vegetation communities, Landsat imagery and in situ flow measurements were combined to produce a more detailed representation of flow resistance. The vegetation in a typical marshland drainage basin in south Florida was classified into five categories using Landsat data. Flow measurements were then performed at characteristic sites in the basin. The measurements were taken at various depths during months of significant flow to examine the effect of seasonal growth. This information was then combined with the areal distribution of the vegetation as measured by satellite to more accurately simulate resistance to water flow in a natural marshland drainage basin. (Author)

**A80-27433 *** **Remote sensing inputs to National Model Implementation Program for water resources quality improvement.** J. C. Eidenshink and F. A. Schmer (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 165-179. 6 refs. Research supported by the U.S. Department of Agriculture; Grant No. NGL-42-003-007.

The Lake Herman watershed in southeastern South Dakota has been selected as one of seven water resources systems in the United States for involvement in the National Model Implementation Program (MIP). MIP is a pilot program initiated to illustrate the effectiveness of existing water resources quality improvement programs. The Remote Sensing Institute (RSI) at South Dakota State University has produced a computerized geographic information system for the Lake Herman watershed. All components necessary for the monitoring and evaluation process were included in the data base. The computerized data were used to produce thematic maps and tabular data for the land cover and soil classes within the watershed. These data are being utilized operationally by SCS resource personnel for planning and management purposes. (Author)

**A80-27434 *** **Improvements in lake water budget computations using Landsat data.** J. C. Gervin (NASA, Goddard Space Flight Center, Eastern Regional Remote Sensing Applications Center, Greenbelt, Md.) and S. F. Shih (Florida, University, Belle Glade, Fla.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 206-218. 8 refs.

A supervised multispectral classification was performed on Landsat data for Lake Okeechobee's extensive littoral zone to provide two types of information. First, the acreage of a given plant species as measured by satellite was combined with a more accurate transpiration rate to give a better estimate of evapotranspiration from the littoral zone. Second, the surface area coupled by plant communities was used to develop a better estimate of the water surface as a function of lake stage. Based on this information, more detailed representations of evapotranspiration and total water surface (and hence total lake volume) were provided to the water balance budget model for lake volume predictions. The model results based on information derived from satellite demonstrated a 94 percent reduction in cumulative lake stage error and a 70 percent reduction in the maximum deviation of the lake stage. (Author)

# 06 HYDROLOGY AND WATER MANAGEMENT

**A80-27436** **Monitoring man's impact in the coastal zone.** A. R. Benton, Jr., W. W. Snell (Texas A & M University, College Station, Tex.), and C. A. Clark (Lockheed Electronics Co., Inc., Houston, Tex.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 237-250. 7 refs.

The paper examines the monitoring of man's impact in the coastal zone. Color infrared photography shows destroyed or degraded wetlands or beaches, and makes possible relevant linear or areal measurements with aerial photography; it can also categorize the environmental impacts which have accrued as the result of completion of water development projects. Aerial photography of the Texas coastal zone illustrates the nature and degree of damage likely to occur as a result of construction or maintenance projects. It is concluded that the method of assigning realistic values to unit areas of wetlands and beaches will make it feasible to incorporate the cost of estuarine damages into the cost estimates of water development schemes. A.T.

**A80-27438** **Near-surface bathymetry system.** G. Schwarz (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, Va.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 261-266.

The paper considers the near-surface bathymeter system which will enable Landsat multispectral images to be projected in a color additive viewer to form a color composite image. The system which consists of a viewer/projector and a Zoom Transfer Scope is described, noting that the operator views the Landsat images and superimposes them on an image of a hydrographic chart. The system operation is described which allows the operator to determine whether any underwater changes have occurred since the last survey, and make possible shoreline changes or corrections. The depth to which the system can penetrate is limited by turbidity, wave action, and the sun angle, but depth penetration of 10 fathoms and greater is possible. A.T.

**A80-30920 *** **Microwave approaches in hydrology.** T. J. Schmugge (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, Apr. 1980, p. 495-507. 38 refs.

The microwave approaches for remote sensing of soil moisture content, snowpack properties, surface water area, and the detection of precipitation over land are discussed. Both active (radar) and passive (radiometry) approaches are considered, and the advantages of microwave sensing are pointed out, including all-weather capability, especially at the longer wavelengths, and greater penetration depth with optical or infrared sensors. Results obtained from ground-based, aircraft, and spacecraft platforms show that microwave systems can monitor the moisture content in the surface soil layer (5 cm thick), and that passive microwave systems can discriminate between light and heavy snowcover, detect the presence of liquid water in the snow, and qualitatively estimate snow water equivalent. L.M.

**N80-16396*#** Maryland Univ. College Park. Dept. of Civil Engineering

**RELATIONSHIP OF PHYSIOGRAPHY AND SNOW AREA TO STREAM DISCHARGE Final Report, 1 Nov. 1976 - 31 May 1979**

Richard H. McCuen, Principal Investigator Oct. 1979 146 p refs ERTS
(Grant NGR-21-002-399)
(E80-10046; NASA-CR-162506) Avail: NTIS HC A07/MF A01 CSCL 08L

The author has identified the following significant results. A comparison of snowmelt runoff models shows that the accuracy of the Tangborn model and regression models is greater if the test data falls within the range of calibration than if the test data lies outside the range of calibration data. The regression models are significantly more accurate for forecasts of 60 days or more than for shorter prediction periods. The Tangborn model is more accurate for forecasts of 90 days or more than for shorter prediction periods. The Martinec model is more accurate for forecasts of one or two days than for periods of 3,5,10, or 15 days. Accuracy of the long-term models seems to be independent of forecast data. The sufficiency of the calibration data base is a function not only of the number of years of record but also of the accuracy with which the calibration years represent the total population of data years. Twelve years appears to be a sufficient length of record for each of the models considered, as long as the twelve years are representative of the population.

**N80-16397*#** Environmental Research and Technology, Inc., Concord, Mass.

**INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Oct. - Dec. 1979**

James C. Barnes, Principal Investigator 7 Jan. 1980 7 p Sponsored by NASA ERTS
(E80-10049; NASA-CR-162521; QPR-9) Avail: NTIS HC A02/MF A01 CSCL 08L

**N80-18498*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**RADAR TARGET FOR REMOTELY SENSING HYDROLOGICAL PHENOMENA Patent**

Wilford E. Sivertson, Jr., inventor (to NASA) Issued 15 Jan. 1980 6 p Filed 22 Sep. 1978 Supersedes N78-33511 (16 - 24, p 3231)
(NASA-Case-LAR-12344-1; US-Patent-4,184,155;
US-Patent-Appl-SN-945041; US-Patent-Class-343-5CM;
US-Patent-Class-343-5W; US-Patent-Class-343-18B;
US-Patent-Class-343-18D) Avail: U.S. Patent and Trademark Office CSCL 08H

An apparatus for remotely measuring and accessing water status relative to snow and glacial melt, surface runoff, rainfall, evaporation, flow rate, and soil moisture is described. A radar target located at a selected location on the surface of the Earth is designed to collect water and render its cross sectional area variable as a function of the height of the water level within the target. The target is remotely monitored by an orbiting or airborne synthetic aperature radar. The target appears as a bright spot embedded within the radar image. The target brightness is indicative of the height of the water level within the ground located target.

Official Gazette of the U.S. Patent and Trademark Office

**N80-18517*#** National Oceanic and Atmospheric Administration, Washington, D. C.

**APPLICATION OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report**

Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 18 Jan. 1980 4 p Sponsored by NASA HCMM
(E80-10068; NASA-CR-162639) Avail: NTIS HC A02/MF A01 CSCL 08L

**N80-18520*#** Calspan Advanced Technology Center, Buffalo, N.Y.

**APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 Aug. - 23 Nov. 1979**

23 Nov. 1979 4 p HCMM
(Contract NAS5-24263)
(E80-10071; NASA-CR-162642; QR-9) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-18522*#** Texas A&M Univ., College Station. Remote Sensing Center.

**CONTINUATION OF MEASUREMENT OF HYDROLOGIC SOIL-COVER COMPLEX WITH AIRBORNE SCATTEROMETERS Final Report**

Bruce J. Blanchard, John L. Nieber, and Andrew J. Blanchard, Principal investigators [1979] 48 p refs ERTS
(Grant NsG-5156)
(E80-10073; NASA-CR-162644; FR-3496) Avail: NTIS HC A03/MF A01 CSCL 08M

The author has identified the following significant results. Analysis of radar scatterometry data obtained over five flight lines in Texas by NASA C-130 aircraft demonstrated that multivariant radar data can be used to distinguish difference in land use, and hence be an indicator of surface runoff characteristics. The capability of using microwave sensors to detect flood inundation of timbered land was also determined.

**N80-18524*#** South Dakota State Univ., Brookings. Remote Sensing Inst.
**HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Oct. - Dec. 1979**
Donald G. Moore, Principal Investigator and J. L. Heilman Dec. 1979 59 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, MD 20771. Domestic users send orders to 'Attn: National Space Science Data Center', non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24206)
(E80-10075; NASA-CR-162646; SDSU-RSI-80-01) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Evidence of a heat sink produced by perched water tables was detected with HCMM night thermal data. The region of shallow water was not visible on HCMM visible or day IR imagery. The results are consistant with previous aircraft investigations.

**N80-18545#** Consiglio Nazionale delle Ricerche, Padua (Italy).
**USE OF SATELLITE IMAGERY FOR THE DERIVATION OF THE HYDROGEOLOGIC CHARACTERISTICS OF A TEST AREA IN SEMIARID CLIMATES**
Carlo Vaccari (Italeco SpA) and Bruno Marcolongo 29 May 1979 12 p Presented at COSPAR Water Resources Symp., Bangalore, India, 30 May - 1 Jun. 1979
Avail: NTIS HC A02/MF A01

The ability to identify locations of underwater storage is especially important in semiarid areas. To this effect, the application of remote sensing by LANDSAT can lead to the identification of potential sites suitable for further ground exploration, thus curtailing the time, labor, and expense of alternative prospecting procedures. The method described utilizes the radiometric information supplied by LANDSAT, together with existing and readily available ground information, to reconstruct the major hydrogeologic features of a semiarid area and to assess in semiquantitative fashion its potential subsurface water content. Author (ESA)

**N80-19591*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MULTISENSOR ANALYSIS OF HYDROLOGIC FEATURES IN THE WIND RIVER RANGE, WYOMING WITH EMPHASIS ON THE SEASAT SAR**
James L. Foster and Dorothy K. Hall, Principal Investigators Oct. 1979 26 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10083; NASA-TM-80582) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. Analysis of imagery obtained over west-central Wyoming indicates that Seasat SAR has capability for hydrologic mapping. Both the L-Band (Seasat) and the X-Band (aircraft) SAR imagery were useful for observing drainage detail. Streams have bright signatures on the SAR imagery because the riparian vegetation produces a rough surface and thus high radar returns. Lakes appear relatively bright on the Seasat image presumably in response to surface ripples and waves induced by wind action. SAR imagery did not reveal snow at either the 23.5 cm (L-Band) or 2.8 cm (X-Band) wavelengths. Comparing Seasat and X-Band aircraft SAR imagery to LANDSAT RBV imagery, U-2 photography, and topographic maps of the Wind River Range, it appears that the SAR data do not seem to provide as much hydrologic information as do the other sensors in the visible and near infrared portions of the spectrum.

**N80-19594#** National Environmental Satellite Service, Washington, D. C.
**NOAA SATELLITE MONITORING OF SNOW COVER IN THE NORTHERN HEMISPHERE DURING THE WINTER OF 1977**
Donald R. Wiesnet, Michael Matson, and David F. McGinnis [1977] 18 p refs
Avail: NTIS HC A02/MF A01

Weekly snow and ice charts were used to prepare mean monthly data on snowcover for both North America and Eurasia. These data were then utilized to prepare simple regressions of antecedent snowcover vs. January, February, February and January-through March snowcover figures, demonstrating a number of statistically significant relationships for Eurasia and the Northern Hemisphere (land surface only). These relationships, despite the limited data sample (10 years of record), indicate that higher-than-average December snowcover tends to presage a winter of more-than-average snowcover. A.R.H.

**N80-20797#** Environmental Monitoring and Support Lab., Las Vegas, Nev.
**AIRBORNE LASER FLUOROSENSING OF SURFACE WATER CHLOROPHYLL a Interim Report, Jan. 1976 - Aug. 1978**
M. Bristow, F. Nielsen, R. Furtek, and J. Baker Aug. 1979 79 p refs Prepared in cooperation with Nev. Univ., Las Vegas
(PB80-113400; EPA-600/4-79-048) Avail: NTIS HC A05/MF A01 CSCL 14B

A prototype airborne laser fluorosensor for monitoring surface water chlorophyll 'a' was tested over Lake Mead, Nevaga. Trends in the remotely sensed data are in close correspondence with ground truth data. It is suggested that system performance can be improved by concurrently gauging the water optical attenuation coefficient and by implementing chlorophyll 'a' analyses on ground truth samples. GRA

**N80-21816#** Norwegian Water Resources and Electricity Board, Oslo
**SNOW AND ICE MAPPING: NORWEGIAN EXAMPLES FOR RUN-OFF PREDICTION**
G. Oestrem, T. Andersen, H. Odegaard (IBM, Oslo), and R. delLlano (IBM, Oslo) *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 177-181 refs

Avail: NTIS HC A12/MF A01

A method which relies on NOAA and TIROS data to evaluate the snow residue and to predict the corresponding melt water volume in a number of Norwegian high mountain basins is described. The method is to be used by hydroelectric power plant managers in order to plan production rates during the melt season. Author (ESA)

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# 07

# DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery

**A80-22382 * #** **The suitability of the ILLIAC IV architecture for image processing.** D. K. Stevenson and R. M. Hord (NASA, Ames Research Center, Moffett Field, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 61-71. 10 refs.

The major architectural features of the ILLIAC IV large scale, array processor are summarized along with their applicability to image processing. Several image processing algorithms are considered, including multispectral classification, texture feature extraction, two-dimensional Fourier transform, and synthetic aperture radar processing. The basic parallelism of the ILLIAC IV (64 processing elements acting in lock-step) is usually fully utilized by the image processing applications. The major architectural aspect of the system with respect to image processing is the relatively small local scratch-pad memory and the long latency time to access the main storage device. The major precision used for the image processing applications is the 32-bit floating point, given a choice of 8-bit integers and 64-bit floating point. B.J.

**A80-22392 * #** **Integration of Landsat, Seasat, and other geo-data sources.** A. L. Zobrist, R. J. Blackwell, and W. D. Stromberg (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 271-280. 7 refs. Contract No. NAS7-100.

The paper discusses integration of Landsat, Seasat, and other geographic information sources. Mosaicking of radar data and registration of radar to Landsat digital imagery are described, and six types of geophysical data, including gravity and magnetic measurements, are integrated and analyzed using image processing techniques. A.T.

**A80-22401 #** **Digital image processing techniques of integrated images and non-image data sets.** P. S. Chavez, Jr., D. K. McMacken, E. Eliason (U.S. Geological Survey, Flagstaff, Ariz.), and J. T. O'Connor (U.S. Geological Survey, Reston, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 432-454. 5 refs.

The present paper deals with several techniques for processing images and for comparing image and nonimage data, which appear to be applicable as aids in the resource planning and management area. The discussion is centered on techniques used to accomplish the major stages of processing: digitize, clean up, and reproduce color images; digitize and create spatial data arrays from contour maps; geometrically correct the image and nonimage data so that they all could be overlaid on a pixel-by-pixel basis; and score the different data sets so they could be directly compared with each other automatically. V.P.

**A80-22404 #** **Operational data collection and platform location by satellite.** J. L. Bessis (Centre National d'Etudes Spatiales, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 485-504.

The paper surveys the Argos data collection and platform location system onboard the Tiros-N satellite, noting that the system is particularly suitable for gathering environmental data in the areas of meteorology, oceanography and earth science. It is noted that unlike conventional data collection and transmission systems using cable and radio links, the Argos system is worldwide. Discussion covers the following areas: user platforms, orbit characteristics, data collection, platform location, operational data processing, interval between data collection and availability and distribution of results. Finally, applications of the Argos system are examined. M.E.P.

**A80-22430 #** **A study of digitized radar images.** A. Shahin and T. Le Toan (Centre d'Etude Spatiale des Rayonnements, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 879-389. 5 refs.

Radar images acquired by the JPL L Band radar over the Northern Toulouse, France are studied. Geometric and radiometric correction techniques are applied on digitized data and the study of sample responses allows estimation of the classification ability of HH and HV L band images for some surface types. Comparison with Visible and IR aerial data is presented. (Author)

**A80-22471 #** **Applying contrast, filtering and smoothing techniques to Landsat images.** M. Hernández (IBM-México, Centro Científico, Mexico City, Mexico) and J. L. del Rio (Instituto Mexicano del Petroleo, Mexico City, Mexico). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1367-1375. 5 refs.

The design and implementation of enhancement, smoothing, and filtering digital techniques for Landsat images are described. The gradient technique is shown to be the technique most indicated for satellite image enhancement. It is concluded that there is a prominent future in the use of contrast, smoothing, and filtering techniques applied to satellite images. V.T.

**A80-22481 * #** **Classification results using spacially correlated Landsat data.** J. D. Tubbs (Arkansas, University, Fayetteville, Ark.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1499-1505. Contract No. NAS13-1608.

Tubbs and Coberly (1978) demonstrated that Landsat multispectral scanner data are not independent random observations, but, are in fact highly correlated. They also demonstrated that the correlation structure for the data is similar to that of a stationary autoregressive process of order one. This paper investigates the effect that serially correlated training data have upon both the estimation of parameters and the classification problem. Results are included for both the Bayesian and maximum likelihood classification procedures. (Author)

**A80-22483 * #** **Autocorrelation in Landsat data.** R. G. Craig (Kent State University, Kent, Ohio). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1517-1524. 12 refs. Contract No. NAS9-13406.

Many computer algorithms for the analysis of Landsat data have a statistical basis which requires that the observations comprise independent samples. Four distinct methods are employed to show that this assumption commonly is not fulfilled for these data. Each leads to a similar conclusion; the data must be sampled no closer than every 10th pixel in order to yield independent estimators. The implications of this are illustrated with a simple example. (Author)

**A80-22484** # **A low cost classification algorithm for developing countries.** H. L. Wagner and G. H. Suits (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1525-1529.

A simple multispectral classification algorithm has been developed which provides good classification accuracy while significantly reducing processing costs. The algorithm offers the user options which minimize the impact of a striped or otherwise corrupted channel; the user also has the option of allowing conflicts in signature recognition to be resolved automatically by a likelihood decision rule, or to provide the program with a priority scheme for the input signatures. A.T.

**A80-22488** # **Integrated survey of natural resources of the low lands of Bolivia using Landsat images.** J. A. Michel. In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1567-1577. 9 refs.

**A80-22498** * # **Quadratic image destriping.** J. T. Dalton and G. E. Winkert (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1697-1705. 5 refs.

An algorithm for removing second-order detector banding effects (striping) from digital imagery is described. This quadratic destriping method is basically an extension of a linear method to one higher degree. It provides a nonlinear alternative between the two-parameter linear correction and a multilinear histogram equalization approach. The application of the proposed technique to GOES visible imagery is discussed, and its effectiveness is compared to existing methods. V.T.

**A80-22511** # **Computation of a data structure for a topographic map using multispectral Landsat scenes.** P. Haberäcker, W. Kirchhof, E. Krauth, G. Kritikos, and R. Winter (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Wessling, West Germany). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1871-1882.

A data structure from Landsat image data containing the land-use information is evaluated. Multivariable classification has been implemented in digital image processing. Verification of the classification results is presented along with reproduction of the results as pictures. Consideration is given to a tree structure and its evaluation. V.T.

**A80-22744** * # **Stereosat - A new astrodynamics challenge.** J. M. Driver (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0237.* 10 p. 7 refs. Contract No. NAS7-100.

The paper investigates the astrodynamics requirements for a spacecraft which produces stereo images of the land masses of the earth for use in geoscience investigations, cartography and earth resource exploration. It describes a candidate Stereosat imaging product, presents criteria for evaluating potential image quality and usability, and assesses the impact of various spacecraft and astrodynamic factors on image quality. Several challenges are identified and discussed, namely (1) securing adequate image quality for pixel level elevation measurements, (2) determining absolute location of imaged phenomena in remote regions, (3) satisfying the long-term orbit prediction requirements, and (4) transmitting accurate orbit data along with the image data stream. Meeting these challenges will greatly enhance operational facility. (Author)

**A80-24073** **Analysis of numerical data handling systems in remote sensing (Analyse de systèmes de traitement numérique en télédétection).** A. Grenon (Ministère des Terres et Forêts, Centre Québécois de Coordination de la Télédétection, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 233-239. 6 refs. In French.

One of the reasons for the increased interest of Landsat data is their easy adaptability to digital computers. In the present paper, some numerical data handling systems are reviewed. B.J.

**A80-25561** * **Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979.** Symposium sponsored by the American Association of Petroleum Geologists, American Society of Agronomy, Crop Science Society of America, ASP, IEEE, NASA, et al. Edited by I. M. Tendam and D. B. Morrison. New York, Institute of Electrical and Electronics Engineers, Inc., 1979. 480 p. $25.

Papers are presented on techniques and applications for the machine processing of remotely sensed data. Specific topics include the Landsat-D mission and thematic mapper, data preprocessing to account for atmospheric and solar illumination effects, sampling in crop area estimation, the LACIE program, the assessment of revegetation on surface mine land using color infrared aerial photography, the identification of surface-disturbed features through a nonparametric analysis of Landsat MSS data, the extraction of soil data in vegetated areas, and the transfer of remote sensing computer technology to developing nations. Attention is also given to the classification of multispectral remote sensing data using context, the use of guided clustering techniques for Landsat data analysis in forest land cover mapping, crop classification using an interactive color display, and future trends in image processing software and hardware. A.L.W.

**A80-25563** * # **Landsat-D data acquisition and processing.** P. L. Smith, Jr. and W. C. Webb (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 13-20.

The Landsat-D system, in which S-band and X-band data links will provide real-time direct transmission of sensor data, is described. System performance objectives include input data quantity of 200 MSS scenes/day and 100 TM scenes/day by the Domestic Communication Satellite, and processing capability, in a pipeline mode, of 2.6 x 10 to the 11th input bits of sensor data per 16-hour day. Data processing techniques, including automated cloudcover assessment, control point library build system, radiometric calibration, and geometric correction are discussed. J.P.B.

**A80-25579** **Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system.** D. A. Stow and J. E. Estes (California, University, Santa Barbara, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 193-201. 13 refs.

**A80-25580** **An image registration algorithm using sampled binary correlation.** E. W. Cordan, Jr. (Martin Marietta Aerospace, Orlando, Fla.) and B. W. Patz (Central Florida, University, Orlando, Fla.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 202-212. 6 refs.

One of the problems associated with the automatic image processing of satellite photographs such as weather maps is the need for image registration; that is, the fitting of a map that has some translational and rotational bias to a known data base. This paper investigates a least squares method of image registration using an image that has been converted into a boundary map with a pixel representation of 1 for land, -1 for water and zero for cloud pixels. A sampled correlation array is constructed about the correlation peak of the binary cross-correlation for the coded satellite map against its data base by shifting the satellite map to locations on a given grid, and performing an accumulation of the pixel-by-pixel comparisons between the satellite image and its data base over the whole map or a smaller search window. A least squares approximation of the translational and rotational bias can then be performed using the data from this sampled correlation array, fitted against a shape such as an elliptical cone. (Author)

**A80-25587** # **Transfer of remote sensing computer technology to the developing world - Case examples.** C. K. Paul (Agency for International Development, Washington, D.C.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 278-283.

The problems that the Agency for International Development has had to face in transferring remote sensing computer technology for image processing to less developed countries (LDCs) that utilize Landsat data are reviewed. These include the necessity to first develop visual analysis skills, variations in computer compatible tape formats, and the capital-intensive technology involved. Attention is also given to actual case examples of the useful development in LDCs of computer facilities, including the advanced digital processing, display and recording techniques used in Egypt, the GEOBOL remote sensing center in Bolivia, deforestation studies in Thailand, and crop identification and measurement in Sri Lanka. J.P.B.

**A80-25588** **IMAGENET - An image analysis network.** P. R. Pearl (DIPIX Systems, Ltd., Ottawa, Canada). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 286-293.

An image analysis network called IMAGENET which incorporates the implementation of public access packet switching networks, reduced cost of high speed digital memory, and advances in microcomputer power, is described. Emphasis is given to a number of microprocessor-controlled remote entry analyzing color terminals, particularly with regard to the time required to transmit an image through the network. J.P.B.

**A80-25589** * # **A system for processing Landsat and other georeferenced data for resource management applications.** S. L. Whitley (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Slidell, La.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 294-303. 7 refs.

The NASA Earth Resources Laboratory has developed a transferrable system for processing Landsat and disparate data with capabilities for digital data classification, georeferencing, overlaying, and data base management. This system is known as the Earth Resources Data Analysis System. The versatility of the system has been demonstrated with applications in several disciplines. A description is given of a low-cost data system concept that is suitable for transfer to one's available in-house minicomputer or to a low-cost computer purchased for this purpose. Software packages are described that process Landsat data to produce surface cover classifications and that geographically reference the data to the UTM projection. Programs are also described that incorporate several sets of Landsat derived information, topographic information, soils information, rainfall information, etc., into a data base. Selected application algorithms are discussed and sample products are presented. The types of computers on which the low-cost data system concept has been implemented are identified, typical implementation costs are given, and the source where the software may be obtained is identified. (Author)

**A80-25590** **Georgia's operational Landsat processing system.** N. L. Faust, L. E. Jordan (Georgia Institute of Technology, Atlanta, Ga.), and B. Q. Rado (Georgia Department of Natural Resources, Atlanta, Ga.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 304-310. 9 refs.

**A80-25594** * **A method for classifying multispectral remote sensing data using context.** P. H. Swain, H. J. Siegel, and B. W. Smith (Purdue University, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 343-353. 15 refs. Contract No. NAS9-15466.

The paper describes a method of classifying multispectral remote sensing data using a context classifier. Because the computational requirements of the context classifier are very large, its implementation on parallel/pipelined multiprocessor systems is being investigated, so that the types of computations can be efficiently implemented. Special considerations necessary for such implementations are discussed, with particular reference to implementation on an array of Control Data Corporation Flexible Processors. A.T.

**A80-26311** # **The geometric correction of Landsat images at the Canada Centre for Remote Sensing (La correction géometrique des images Landsat au Centre Canadien de Télédétection).** F. E. Guertin, T. J. Butlin, and R. G. Jones (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). *(Groupement pour le Développement de la Télédétection Aérospatiale, Colloque International, 3rd, Toulouse, France, June 19-22, 1979.) Canadian Journal of Remote Sensing,* vol. 5, Dec. 1979, p. 118-127. 6 refs. In French.

To facilitate the integration of Landsat multi-spectral imagery with other geobase information systems, the Canada Centre for Remote Sensing has developed a precision processed image product in the Universal Transverse Mercator (UTM) projection, offered to the users on computer compatible tapes. The images are geometrically corrected and rotated in order to align the pixels on the UTM metric grid. Pixels are resampled to 50 sq m. To be compatible with the National Topographic System, the Landsat images are divided into 0.5 deg latitude by 1.0 deg longitude quadrangles corresponding to four map sheets in the 1:50,000 series or one quarter of a map sheet in the 1:250,000 series. These images are generated on a digital image correction system composed of a minicomputer, standard peripherals, an image display terminal for ground control points acquisition and a micro-programmed corrector. (Author)

**A80-26750** # **A Landsat digital examination of Khumbu glacier, Nepal.** D. C. Rundquist and S. A. Samson (Nebraska, University, Omaha, Neb.). *Remote Sensing Quarterly,* vol. 2, Jan. 1980, p. 4-15. 19 refs. Research supported by the United Nations.

The analysis of a glacier in eastern Nepal by means of Landsat computer-compatible tape data is reported. The tape for eastern Nepal was subjected to single-channel thresholding, parallelpiped classification, and unsupervised and supervised classification, and results were compared with ground truth in the forms of detailed maps and verbal descriptions of the region. MSS channel 5 is found to be the most useful channel for distinguishing the snow, firn, clean ice, debris-covered ice, and moraine regions of the glacier, and unsupervised clustering using all four Landsat bands and seven cluster classes confirmed the existence of a statistical decision boundary between the clean ice and snow on the glacier. It is concluded that Landsat digital data can be used to prepare rapidly and inexpensively useful glacier maps identifying major surface features (glacial outline, accumulation and ablation zones, debris-covered ice, clean ice, snow, and firn). A.L.W.

**A80-27428** **Landsat-D sensor data product generation.** J. Danaher and O. J. Inscoe (General Electric Co., Lanham, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 30-38.

For the Landsat-D mission, NASA is developing a separate and dedicated facility at the Goddard Space Flight Center. This separate facility, designated the Data Management System (DMS), will provide for autonomous development and integration of the Landsat-D system without disrupting ongoing Landsat 1, 2, and 3 operations. The DMS employs digital processing techniques and communications satellites to minimize the loss of information between the sensor output and the ultimate user. This is to be accomplished by providing timely delivery of master data products to the public domain facility located at Sioux Falls, South Dakota. In addition, products will be provided to a Landsat Assessment System (LAS) facility, which will function as the research and development arm of the Landsat-D mission. (Author)

**A80-27429 *** **Spatial quantification of maps or images - Cell size or pixel size implications.** M. E. Wehde (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 45-64. 7 refs. Grant No. NGL-42-003-007.

The paper discusses spatial quantification of maps or images. Spatial accuracies evaluated by mapping and inventory measures were observed with a range of cell sizes for a 10.36 sq km soil survey segment. The distribution of interboundary distances in a map was evaluated as unique, characterizing information; experimentally observed relationships between accuracy and cell size and interboundary distance distribution parameters and cell size led to a model of the process of spatial quantization. Grid positioning effects were evaluated and were significant only at the level of individual mapping units; two generations of 'universal' process models were derived, implemented, and evaluated. A.T.

**A80-27432 *** **Error detection and rectification in digital terrain models.** M. J. Hannah (NASA, Ames Research Center, Institute for Advanced Computation, Moffett Field, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 152-164. 5 refs.

Digital terrain models produced by computer correlation of stereo images are likely to contain occasional gross errors in terrain elevation. These errors typically result from having mismatched sub-areas of the two images, a problem which can occur for a variety of image- and terrain-related reasons. Such elevation errors produce undesirable effects when the models are further processed, and should be detected and corrected as early in the processing as possible. Algorithms have been developed to detect and correct errors in digital terrain models. These algorithms focus on the use of constraints on both the allowable slope and the allowable change in slope in local areas around each point. Relaxation-like techniques are employed in the iteration of the detection and correction phases to obtain best results. (Author)

**A80-29978 *** **Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory.** W. B. Green, N. A. Bryant, P. L. Jepsen, R. G. McLeod, J. A. Mosher, R. H. Selzer, W. D. Stromberg, G. M. Yagi, and A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Optical Engineering*, vol. 19, Mar.-Apr. 1980, p. 168-179. 17 refs. Contract No. NAS7-100.

During the past decade advanced techniques have been developed at JPL for processing large volumes of imagery returned by the more recent planetary spacecraft. In addition, the Image Processing Laboratory has become involved in the processing of earth resources imagery acquired by Landsat and a variety of other sensors flown on aircraft and spacecraft. The trend within the facility has been toward the development of technology capable of processing increasingly larger image data bases. A variety of applications in both the planetary and earth observations areas involve the merging and/or processing of more than one image and often require the correlation of data acquired by a variety of sensors. B.J.

**A80-30922** **Different considerations in coastal mapping.** S. E. Masry and S. MacRitchie (New Brunswick, University, Fredericton, Canada). *(International Society for Photogrammetry, Inter-Congress Symposium, Ottawa, Canada, Oct. 2-6, 1978.) Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 521-528. 11 refs.

Water penetration, refraction, and incomplete stereomodels are the three main problems in photogrammetric mapping of coastal waters. These problems, together with the different means for overcoming them, are discussed. In particular, the use of simultaneous photography from two aircraft, inertial navigation, black-and-white infrared photography, and lidar are analyzed. The objective of the analysis is to acquire an insight into the configuration and requirements of a universal coastal mapping system. (Author)

**A80-30923** **A calibration procedure for Fourier series thermal inertia models.** D. A. Pratt, S. J. Foster, and C. D. Ellyett (Newcastle, University, Newcastle, Australia). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 529-538. 20 refs.

A simple, linear Fourier series model for the calibration of airborne and satellite thermal inertia surveys has been developed which requires only a single calibration point. Information obtained from this single calibration point is sufficient to allow the prediction of the diurnal ground surface temperature fluctuation over a wide range of thermal inertia and albedo values. Not only does this model include the radiative energy exchange of the ground surface, but also the turbulent energy transfer. The model is simple and rapid to compute and provides an absolute tie between the remote sensing data and the ground thermal properties. (Author)

**A80-31977** **What is an analytical plotter (Qu'est-ce qu'un restituteur analytique).** P. Munier (Institut Géographique National, Saint-Mandé, Val-de-Marne, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 23-37. In French.

Analytical stereoplotters are a new generation of photogrammetric plotting systems. This paper reviews the design and operation of analytical plotters; attention is given to the architecture, the optical-mechanical unit, the electronic unit, and the data unit and peripherals. Special emphasis is placed on the logic structure of the plotter. B.J.

**A80-31980** **Compatibility of analytical plotters with digital imagery in the plotting of variable spaces (Compatibilité des restituteurs analytiques avec l'imagerie digitale dans la restitution d'espaces variés).** B. Dubuisson. In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 129-139. In French.

Some aspects of the use of analytical plotters in photogrammetric cartography are reviewed. Attention is given to: (1) the adaptability of the plotter, (2) automation techniques based on digital correlation, and (3) the general processing of digital imagery by the analytical plotter. B.J.

**A80-31996** **An interactive software for plotting thematic maps.** S. Vetrella, A. Moccia, and C. Tripodi (Napoli, Università, Naples, Italy). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 482-489. Consiglio Nazionale delle Ricerche Contracts No. 76.0015; No. 76,00518,07.

The paper presents an overview of the CATART Interactive Digital Analysis System (CIDAS) for use with data from aerospace remote sensing platforms. A description of the basic overall system philosophy is presented that shows the structure and results of overlays used to get automatic thematic maps. Flowcharts of the analog and digital analysis system are presented along with the CIDAS software block diagram. C.F.W.

**A80-32101** * **The seasonal cycle of snow cover, sea ice and surface albedo.** A. Robock (Maryland, University, College Park, Md.). *Monthly Weather Review*, vol. 108, Mar. 1980, p. 267-285. 41 refs. Grant No. NsG-5209.

The paper examines satellite data used to construct mean snow cover caps for the Northern Hemisphere. The zonally averaged snow cover from these maps is used to calculate the seasonal cycle of zonally averaged surface albedo. The effects of meltwater on the surface, solar zenith angle, and cloudiness are parameterized and included in the calculations of snow and ice albedo. The data allows a calculation of surface albedo for any land or ocean 10 deg latitude band as a function of surface temperature ice and snow cover; the correct determination of the ice boundary is more important than the snow boundary for accurately simulating the ice and snow albedo feedback. A.T.

**A80-32262** **Space photography and thematic mapping - A method for processing multichannel photography (Kosmicheskaia s'emka i tematicheskoe kartografirovanie - Metodika obrabotki mnogozonal'nykh snimkov).** Edited by K. A. Salishchev and Iu. F. Knizhnikov. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979. 232 p. In Russian.

The use of multispectral aerial and space photographs for the construction of thematic (e.g., landscape, geomorphological, hydrological, and economic) maps is considered. Attention is also given to methods for processing multispectral photographs; such topics as photometric measurements, color-image synthesis, automatic classification, and digital processing are covered. B.J.

**A80-32266** # **Method for the photometric interpretation of multispectral aerial photographs (Metodika fotometricheskogo deshifrovaniia mnogozonal'nykh aerofotosnimkov).** I. A. Labutina and L. A. Kovrizhnykh. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 33-39. In Russian.

A microphotometric technique for the interpretation of multispectral photographs is described; its accuracy is considered and distributions of normalized photometric image characteristics are presented. The technique has been applied to the interpretation of photographs of agricultural areas, river flows, and terrain erosion characteristics. B.J.

**A80-32267** # **Comparison of registograms in the microphotometric interpretation of multispectral photographs (Sopostavlenie registrogramm pri mikrofotometricheskom deshifrirovanii mnogozonal'nykh snimkov).** V. I. Kravtsova. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 39-45. In Russian.

Procedures of visual comparison in the photometric interpretation of multispectral photographs are presented. The method is a relatively simple one, based on the comparison of registograms obtained in the measurement of multispectral negatives. The interpretation of some aerial photographs of different soil types is considered by way of illustration. B.J.

**A80-32279** # **Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas (Ispol'zovanie mnogozonal'nykh kosmicheskikh snimkov pri sozdanii landshaftnoi karty poluostrovov Mangyshlak i Buzachi).** A. F. Voronina. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 139-148. In Russian.

**A80-32282** # **Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria (Eksperiment po kompleksnomu deshifrirovaniiu mnogozonal'nykh skanernykh aerosnimkov Narodnoi Respubliki Bolgarii).** V. I. Kravtsova, Kh. B. Spiridonov, and E. K. Misheva. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 159-180. In Russian.

**N80-16392*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**EVALUATION OF REGISTRATION, COMPRESSION, AND CLASSIFICATION ALGORITHMS. VOLUME 2: DOCUMENTATION**
R. Jayroe, Principal Investigator, R. Atkinson, L. Callas, J. Hodges, B. Gaggini, and J. Peterson Feb. 1979 331 p refs ERTS
(E80-10042; NASA-TM-78227) Avail: NTIS HC A15/MF A01 CSCL 08B

**N80-16405*#** National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
**SYNTHETIC APERTURE RADAR/LANDSAT MSS IMAGE REGISTRATION**
H. E. Maurer, ed., J. D. Oberholtzer, ed., and P. E. Anuta, ed. (Purdue Univ.) Jun. 1979 233 p Sponsored in part by Goodyear Aerospace Corp. Original contains color illustrations
(Contracts NAS6-2816; NAS6-2827)
(NASA-RP-1039) Avail: NTIS HC A11/MF A01 CSCL 17I

Algorithms and procedures necessary to merge aircraft synthetic aperture radar (SAR) and LANDSAT multispectral scanner (MSS) imagery were determined. The design of a SAR/LANDSAT data merging system was developed. Aircraft SAR images were registered to the corresponding LANDSAT MSS scenes and were the subject of experimental investigations. Results indicate that the registration of SAR imagery with LANDSAT MSS imagery is feasible from a technical viewpoint, and useful from an information-content viewpoint. J.M.S.

**N80-19586*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems and Services Div.
**AS-BUILT DESIGN SPECIFICATIONS OF THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES). VOLUME 1: TEST AND APPENDICES**
J. Everette, A. Rios, J. Good, C. Horton, D. McCarley, and M. Nieves, Principal Investigators Dec. 1979 335 p ERTS
(Contract NAS9-15800)
(E80-10077; NASA-CR-160461; LEC-12904-Vol-1; JSC-14634-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 05B

**N80-20651#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**THE TRIANGULATION NETWORK IN WEST GERMANY [UNTERSUCHUNGEN IM HAUPTDREIECKSNETZ DER BUNDESREPUBLIK DEUTSCHLAND]**

Dieter Ehlert *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 127-130 refs In GERMAN

Avail: NTIS HC A11/MF A01

The development of the West German triangulation system is described. The precision of the network, including improvements, is examined. Corrections to consider in the experimental techniques and mathematical approach are discussed. Author (ESA)

**N80-20654#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**CARTOGRAPHY APPLICATIONS AND RESEARCH [DIE KARTOGRAPHIE IN PRAXIS UND FORSCHUNG]**

Walter Satzinger *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 141-142 In GERMAN

Avail: NTIS HC A11/MF A01

The evolution of cartography in response to growing needs for more precise representation is briefly related. Progress in reprography and data processing have results in improved quality at lower cost. The increasing number of applications of cartography to photogrammetry are mentioned. Author (ESA)

**N80-20655#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DEVELOPMENT, STATUS, AND GOALS OF CARTOGRAPHIC AUTOMATION [ENTWICKLUNG, AUFGABENSTELLUNG UND ZIELE DER KARTOGRAPHISCHEN AUTOMATION]**

Wilhelm L. Pfrommer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 143-148 In GERMAN

Avail: NTIS HC A11/MF A01

Progress in cartography with the development of automation is related briefly. Equipment in use by the EDV includes an interactive digitizing system (ARISTOGRID CD400), a cartographic automation system (coragraph DC3), and a high precision drafting table (coragraph 1700). Author (ESA)

**N80-20656#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**AUTOMATIC ACQUISITION AND PROCESSING OF CARTOGRAPHIC DATA [AUTOMATIONSGESTVETZTE ERFASSUNG UND AUFBEREITUNG KARTOGRAPHISCHER DATEN]**

Theodor Johannsen *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 149-156 In GERMAN

Avail: NTIS HC A11/MF A01

The acquisition and processing of cartographic data is examined. Cartographic data gathered through photogrammetry, statistics or other means are digitized for computation; coordinates of points, their nature and alphanumeric symbols are recorded. Automatic drawing from optical sensors or scanners is described along with error control and correction procedures. Examples are given of the relative precision obtained at different production rates. Author (ESA)

**N80-20657#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON PRECISION IN THE GATHERING AND PRODUCTION OF CARTOGRAPHIC DATA [GENAUIGKEITSUNTERSUCHUNGEN BEI ERFASSUNG UND AUSGABE KARTOGRAPHISCHER DATEN]**

Theodor Johannsen *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 157-159 In GERMAN

Avail: NTIS HC A11/MF A01

The accuracy of digitizers in analog to digital conversion is examined. Measurements show that the scale error introduced is inferior to the resolution power of the apparatus. Improved precision can be obtained by means of an optical interferometer. Errors introduced by manual operations are discussed. Satisfactory results are obtained in the case of same-scale work and also when translating to a smaller scale. Author (ESA)

**N80-20658#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**COMPUTER BASED GENERALIZATION FOR THE ELABORATION AND EXTENSION OF TOPOGRAPHIC MAPS [RECHNERGESTUEZTE GENERALISIERUNG BEI DGR HERSTELLUNG UND FORTFUEHRUNG TOPOGRAPHISCHER KARTEN]**

Fred Christ *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 161-165 refs In GERMAN

Avail: NTIS HC A11/MF A01

Research and programming for a computer based system for automatic mapping is described. The concept of calculator-based map generalization is exposed. Interactive, semi-automatic, and automatic generalization systems are presented. Author (ESA)

**N80-20659#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**GRAPHIC PRODUCTION OF MAPS ON SCREENS OR PHOTOCOMPOSITION DEVICES [GRAPHISCHE AUSGABE VON KARTEN AUF BILDSCHIRM UND LICHTZEICHENMASCHINE]**

Helmut Uhrig *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 167-169 In GERMAN

Avail: NTIS HC A11/MF A01

Two image retrieval systems are described and compared. A cartographic system is discussed which converts numeric map data into analog images either on a screen or on a precision charting machine. Choice of a system depends on the desired speed and precision. Author (ESA)

**N80-20665#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON SPECTRAL SIGNATURES IN CENTRAL PERSPECTIVE REPRESENTATION [ZUR BERUECKSICHTIGUNG VON OBJEKTEIGENSCHAFTEN IN ZENTRALPERSPEKTIVEN ABBILDUNGEN]**

Joern Sievers *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 193-197 refs In GERMAN

Avail: NTIS HC A11/MF A01

Object signature in aerial photography is briefly studies. Nonuniformity in tone (over the picture) due to sunlight reflection in vertical photographs is discussed, and the effect of different Sun angles is shown in several photographs. Author (ESA)

**N80-20669#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DIGITAL HEIGHT MODEL WITH ITEK CORRELATOR [DIGITALES HOEHENMODELL MIT DEM ITEK KORRELATOR]**

Gerhard Lindig *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 219-223 refs In GERMAN

Avail: NTIS HC A11/MF A01

Emphasis is given to the utilization of this model in the restitution of orthophotos. The most important factors taken into consideration include: determination of heights as accurately as possible; obtaining the least possible drop in correlation; rapid extraction of correlation; avoidance or domination of Floats; avoidance or recognition of Swings; elimination of systematic adaptation of parameters to different local conditions; filling in correlation loss gaps. It is concluded that the ITEK correlator EC5 can greatly contribute to the obtaining of height information for the orthophoto and also for height line maps. Author (ESA)

**N80-20670#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE FUTURE OF ANALYTICAL EVALUATION EQUIPMENT [ERWARTUNGEN AN ANALYTISCHE AUSWERTEGERAETE]**

Karl Schuerer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 225-227 refs In GERMAN

Avail: NTIS HC A11/MF A01

Developments in image measurement techniques are covered with emphasis on comparators and analog evaluation techniques. Advantages and disadvantages found in both techniques are considered. The feasibility of an apparatus incorporating the advantages of both systems and computer technology is addressed. Applications in practical photogrammetry and in the field of research are included. Author (ESA)

**N80-20671#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DIGITAL MAP BASES FROM PHOTOGRAMMETRIC MEASUREMENTS [DIGITALE KARTENGRUNDLAGEN AUS PHOTOGRAMMETRISCHEN MESSUNGEN]**

Hermann G. Neubauer *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 229-231 In GERMAN

Avail: NTIS HC A11/MF A01

Progress in electronic data processing has led to the development of accurate automated equipment for the production of all types of maps, systems, in which out-of-date information is eliminated and new objects, of particular interest, are introduced. Various calculation procedures associated with the transfer of measured data to digital maps are indicated: adaptation to the map's coordinate system; division of stereogram areas into areas of similar usage; association of measurements from adjacent stereograms; incorporation of modifications from field comparisons; preparation of data for storage in data banks. The automatic generation of height lines from discrete points is discussed. The corresponding coloration of different cultures can also be handled in this way. Author (ESA)

**N80-20672#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**TASKS AND POSSIBILITIES OF DIGITAL IMAGE DATA PROCESSING IN PHOTOGRAMMETRY [AUFGABEN UND MOEGLICHKEITEN DGR DIGITALEN BILDVERARBEITUNG IN DGR PHOTOGRAMMETRIE]**

Bernd-Siegfried Schulz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 233-235 In GERMAN

Avail: NTIS HC A11/MF A01

A technique to accelerate fabrication and improve the quality of topographic maps made from primary data is described. Applications include remote sensing from aircraft and satellites. The treatment of data from LANDSAT 1, 2, and 3 is discussed. Optical and geometrical effects are corrected and contrast enhanced. High sensitivity is achieved enabling various surface coverages to be identified and studied in detail (different types of region, forests, geographical, and geological features). Correlations between different parts of a single image and between different images are studied and exploited. Author (ESA)

**N80-20705#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**REPORTS ON CARTOGRAPHY AND TOPOGRAPHICAL MEASUREMENTS. SERIES 1: ORIGINAL REPORTS [NACHRICHTEN AUS DEM KARTEN UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NO. 77]**

1978 179 p refs In GERMAN; ENGLISH summary Original contains color illustrations

(Rept-77; ISSN-0469-4236) Avail: NTIS HC A09/MF A01

Eight papers are presented dealing with photogrammetry, remote sensing, data enhancement using computer techniques (including least squares calulations), and application of Skylab and LANDSAT data to small scale cartography. Also treated are the production and analysis of multispectral images, definition of a reflective quantity for remote sensing data, and a calculation method for setting data for analog plotters.

**N80-20707#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE PROBLEM OF OBTAINING DATA FOR THE DIGITAL HEIGHT MODEL [PROBLEME DER DATENGEWINNUNG FUER DAS DIGITALE HOEHENMODELL]**

Gerhard Lindig *In its* Rept. on Cartography and Topographical meas. Ser. 1: Original Rept. 1978 p 37-48 refs In GERMAN; ENGLISH summary Presented at Intern. Symp. der IGP, Komm 3, Moscow, 1978

N80-20705 11-42)

Avail: NTIS HC A09/MF A01

The point coordinates for the Digital Height Model were measured with the necessary accuracy by photogrammetric methods. Problems were encountered in obtaining correct ground heights for wooded and built-up areas, for breaks of slope or for large fields with poor contrast by manual as well as by automatic scanning. These problems were solved only by improving the original data using computer tecnniques. Author (ESA)

**N80-20708#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**A METHOD FOR EXAMINING RELATIONSHIPS BETWEEN MULTISPECTRAL DATA [EINE METHODE ZUE PRUEFUNG CON ABHAENGIGKEITEN ZWISCHEN MULTISPEKTRALEN DATEN]**

Bernd-Siefgried Schulz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 49-69 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

A method to examine multispectral vectors of characteristics with regard to significant difference applied for instance, to problems of spectral object spearation, is presented. This method differs from former procedures by using (least squares) adjustment and visual evaluation of the corrections obtained as a result. The method saves computing time and can also be applied to large quantities of data. The method is tested through the use of several examples. Author (ESA)

**N80-20711#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON THE WRITING ACCURACY OF THE REPRODUCTION UNIT OF THE OPTRONICS SYSTEM P1700 [ZUR SCHRIEB-GENAUIGKEIT DER WEIDERGABEEINHEIT IM OPTRONICS SYSTEM P1700]**

Bernd-Siegfried Schulz *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 141-148 In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

A method for determining the accuracy of the plotting system of a digital image scanning device is described. A method is shown for eliminating linear affine distortions by introducing corrections into the writing mechanism. Author (ESA)

**N80-20719** Tennessee Univ., Knoxville.

**APPLICATION OF LANDSAT IMAGERY TO MONITOR SAND DUNES MOVEMENT IN THE SAHARA DESERT Ph.D. Thesis**

Ahmed Mokhtar Brera 1979 347 p

Avail: Univ. Microfilms Order No. 8005371

Band 5 and band 7 imagery available from LANDSAT 1 and LANDSAT 2 for the period between 1972 and 1976 over selected test areas in the Libyan Desert was used to identify and map distinct units on the ground. The results obtained were supported by ground truth data obtained from the selected sites in he form of topographic, geologic, and soil maps, aerial photographs, and meteorological information. The findings indicate that global surveillance of the status of dryland ecosystems and of land use can be achieved most economically through the use of LANDSAT imagery if proper image analysis techniques are used. Sand dune movement of the magnitude one kilometer and more can be detected easily using the proposed system. Dissert. Abstr.

# 07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

**N80-20766*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IMPROVEMENT IN CLASSIFICATION ACCURACY OF LANDSAT MSS DATA IN AREAS OF MOUNTAINOUS TERRAIN**
C. Justice, B. Holben, and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 220-223 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 05B

**N80-20767*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SOURCES OF VARIATIONS IN LANDSAT AUTOCORRELATION**
M. L. Labovitz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 224-227 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 05B

## 08

## INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

**A80-22380 * #** **The Massively Parallel Processor and its applications.** J. P. Strong, D. H. Schaefer, J. R. Fischer, K. R. Wallgren, and P. A. Bracken (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 37-45.

A long-term experimental development program conducted at Goddard Space Flight Center to implement an ultrahigh-speed data processing system known as the Massively Parallel Processor (MPP) is described. The MPP is a single instruction multiple data stream computer designed to perform logical, integer, and floating point arithmetic operations on variable word length data. Information is presented on system architecture, the system configuration, the array unit architecture, individual processing units, and expected operating rates for several image processing applications (including the processing of Landsat data). B.J.

**A80-22381 #** **The CCRS Image Analysis Processor.** D. G. Goodenough, W. M. Strome (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and S. F. Gourley (DIPIX Systems, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 47-59. 9 refs.

The Image Analysis Processor (IAP) was designed to meet three processing needs in the Image Analysis System of the Canada Centre for Remote Sensing: (1) classification with the maximum likelihood decision rule, (2) computation of two-dimensional Fourier transforms, and (3) high-speed image transfers to the display refresh memory. The IAP operates in parallel, internally and externally, to permit, for example, the classification of a full Landsat frame into 32 classes in about six minutes, which compares favorably with the four minutes required on the ILLIAC IV. This paper gives an overview of the Image Analysis System and describes IAP hardware and operations. B.J.

**A80-22390 #** **Multi-sensor Landsat MSS registration.** S. S. Rifman, A. T. Monuki, and C. P. Shortwell (TRW Defense and Space Systems Group, Redondo Beach, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 245-258. 13 refs.

An account is given of the methods developed for precision registration of full scene MSS data obtained from different Landsat spacecraft. Results are presented for Landsat 1/2 scene registration as well as multitemporal registration of data from the same satellite. Direct cross correlation measurements show registration accuracies of about 1/3 pixel for Landsat 1/2. (Author)

**A80-22391 #** **Correction of synthetic aperture radar and multispectral scanner data sets.** D. G. Goodenough, B. Guindon, and P. M. Teillet (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 259-270. 5 refs.

Techniques developed for the radiometric and geometric correction of satellite and airborne SAR and MSS data are described with reference to agricultural data acquired in Canada. It is found that the use of a digital terrain model along with an aircraft altitude model would allow the rectification of large SAR images to a UTM projection. The classification and interpretation of SAR images are significantly improved if the data are median-filtered. With median-filtered SAR data, an average classification accuracy of 82 plus or minus 4 sem % was obtained for the classification of corn, trees, and alfalfa; and wheat, soybeans, and soybean stubble. B.J.

**A80-22409 * #** **Signature evaluation of natural targets using high spectral resolution techniques.** W. Collins (NASA, Goddard Institute for Space Studies; Columbia University, New York, N.Y.) and H.-Y. Chiu (Geophysical and Environmental Research, Inc.; Columbia University, New York, N.Y.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 567-582. 7 refs.

The concept of 'spectral signature' identification has been applied to LANDSAT and other broad-band multi-spectral scanner data to classify various materials on the earth's surface. A large amount of the spectral information available is invisible, however, to the broad-band sensors. Although the natural targets of interest in remote sensing do not exhibit fine line features such as those associated with gaseous media, there is significant information to be extracted from smoothly varying spectral reflection functions of most natural targets. Subtle variations observed recently in the high resolution 'spectral signatures' of vegetation targets, in particular, promise to open new avenues of application using higher spectral and radiometric resolution techniques. This research was accomplished using a 500-band spectroradiometer system specially adapted to rapid airborne operations. (Author)

**A80-22420 * #** **Surface temperature variations as measured by the Heat Capacity Mapping Mission.** J. C. Price (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 765-770. 7 refs.

The AEM-1 satellite, the Heat Capacity Mapping Mission, has acquired high-quality thermal infrared data at times of day especially suited for studying the earth's surface and the exchange of heat and moisture with the atmosphere. Selected imagery illustrates the considerable variability of surface temperature in and around cities, in the dry southwestern United States, in the Appalachian Mountains, and in agricultural areas. Through simplifying assumptions, an analytic experience is derived that relates day/night temperature differences to the near-surface layer (thermal inertia) and to meteorological factors. Analysis of the result suggests that, in arid regions, estimates of relative thermal inertia may be inferred, whereas, in agricultural areas, a hydrologic interpretation is possible. (Author)

**A80-22425 * #** **Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah.** V. Gornitz (NASA, Goddard Institute for Space Studies; Columbia University, New York, N.Y.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 825-834. 15 refs. Grant No. NsG-5163.

**A80-22442 #** **Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data.** J. Dejace, J. Mégier, M. Kohl, G. Maracci, P. Reiniger, G. Tassone (EURATOM and Comitato Nazionale per l'Energia Nucleare Centro Comune di

Ricerche, Ispra, Italy), and J. Huygen. In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1015-1024. 9 refs.

A multiple search and interpolation method has been developed in order to use the 'Tell-us' model to map thermal inertia, soil moisture and cumulative daily evaporation by starting from thermal and visible data acquired by air borne scanner. Interpolations are made within and between look-up tables generated previously by the model which uses a reverse temperature simulation process. After the necessary geometric, radiometric and atmospheric corrections have been applied, the scanner data are processed together with ground and meteorological data to produce moisture and evaporation maps. Comparison with available measurements indicates a tendency to underestimate soil moisture content; a similar trend seems to be also verified for cumulative daily evaporation. Mapping of locally non-homogeneous areas encounters some difficulties which are discussed. (Author)

**A80-22472 * # Geometric correction of satellite data using curvilinear features and virtual control points.** V. R. Algazi, G. E. Ford, and D. I. Meyer (California, University, Davis, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1377-1383. 6 refs. Grant No. NsG-5092.

A simple, yet effective procedure for the geometric correction of partial Landsat scenes is described. The procedure is based on the acquisition of actual and virtual control points from the line printer output of enhanced curvilinear features. The accuracy of this method compares favorably with that of the conventional approach in which an interactive image display system is employed. (Author)

**A80-22513 # Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South.** M. Araya (Chile, Universidad; Instituto Antártico Chileno, Santiago, Chile). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1895-1906.

Remote sensing techniques are being employed to study the natural resources of remote, rough areas of Chile. Airborne sensors including a multiband camera, a thermal infrared scanner, and conventional B/W photography are being used to study the geothermal resources of the Atacama Desert. In addition, a multidisciplinary approach to gathering environmental data on the Chilean Antarctic Territory is discussed, with emphasis on the Landsat satellite working in conjunction with automatic data collection platforms including the Weddell Sea installation. J.P.B.

**A80-24075 The ROS-580 Project (Le Projet ROS-580).** K. P. B. Thomson and R. T. Lowry (Intera Environmental Consultants, Ltd., Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 251-264. 28 refs. In French.

ROS-580 is the airborne part of the Canadian SURSAT program. An ERIM four-channel synthetic aperture radar was installed on the Convair 580 aircraft of the Canada Centre for Remote Sensing. Experiments flown between June 1978 and May 1979 collected data across Canada in four major discipline areas: oceans, ice, human activities, and renewable resources. The planning of the SAR-580 project is examined, and preliminary results for several experiments are given. B.J.

**A80-25332 * Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/.** E. G. Njoku (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *(Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) Boundary-Layer Meteorology,* vol. 18, Feb. 1980, p. 79-98. 12 refs.

Procedures for correcting antenna temperature measurements and retrieving the true brightness temperatures are developed for the Scanning Multichannel Microwave Radiometer (SMMR) flown on the Seasat-A and Nimbus-G satellites. These procedures are necessary to meet the measurement accuracies required for deriving sea surface temperatures and wind speeds. It is shown that sidelobe contributions and polarization cross-coupling are major effects to be accounted for, in addition to some unique features of the SMMR instrument such as integration times and antenna scan characteristics. Methods are presented for data averaging and data reformatting, these are to be used with geophysical parameter retrieval algorithms. (Author)

**A80-25567 Landsat MSS coordinate transformations.** B. K. P. Horn (MIT, Cambridge, Mass.) and R. J. Woodham (British Columbia, University, Vancouver, Canada). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 59-68. 11 refs.

A number of image analysis tasks require the registration of a surface model with an image. In the case of satellite images, the surface model may be a map or digital terrain model in the form of surface elevations on a grid of points. An affine transformation is developed between coordinates of Multi-Spectral Scanner (MSS) images produced by the Landsat satellites, and coordinates of a system lying in a plane tangent to the earth's surface near the sub-satellite (Nadir) point. (Author)

**A80-25592 An approach to nonlinear mapping for pattern recognition.** N. Duong, R.-M. Li, and D. B. Simons (Colorado State University, Fort Collins, Colo.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 323-330. 10 refs.

A two-stage process of nonlinear mapping for pattern classification is presented. In the first stage, a data-straightening operation is used to obtain the new configuration of the training data points in a one-dimensional space, in the second stage, pattern classification is conducted in the one-dimensional transformed space through the use of a minimum-resistance rule. C.F.W.

**A80-25770 * # Enhancement of remote sensing through microwave technology.** M. Cehelsky (NASA, Office of Space and Terrestrial Applications, Washington, D.C.) and J. Kiebler (NASA, Goddard Space Flight Center, Communications Technology Div., Greenbelt, Md.). *ITU Telecommunication Journal,* vol. 47, Jan. 1980, p. 28-34. 16 refs.

This overview begins with a brief look at remote sensing to date, focusing on the state of the art and the benefits that have been derived from it. Current and future microwave sensing developments are discussed pointing out special advantages and capabilities and noting the anticipated benefits. The frequency requirements of microwave sensing are outlined and the particular need to both allocate, and when necessary, protect active and passive operational sensing frequencies is emphasized. V.T.

**A80-26085 * # The Surface Contour Radar, a unique remote sensing instrument.** J. E. Kenney, E. A. Uliana (U.S. Navy, Naval Research Laboratory, Washington, D.C.), and E. J. Walsh (NASA, Wallops Flight Center, Wallops Island, Va.). *(Institute of Electrical and Electronics Engineers, International Microwave Symposium, Orlando, Fla., Apr. 30-May 2, 1979.) IEEE Transactions on Microwave Theory and Techniques,* vol. MTT-27, Dec. 1979, p. 1080-1092. 6 refs.

A 36 GHz computer controlled airborne Surface Contour Radar (SCR) is described, which was developed by the Naval Research Laboratory and NASA. The system uses pulse-compression techniques and dual frequency carriers spaced far enough apart to be decorrelated on the sea surface. The continuous wave transmitter is biphase modulated, the return signal is autocorrelated, and the code length and clock rate are variable, providing selectable range resolutions of 0.15, 0.30, 0.61 and 1.52 m. The SCR generates a false-color coded elevation map of the sea surface below the aircraft in real time, and can routinely produce ocean directional wave spectra with off-line data processing. J.P.B.

**A80-26317 *** **Observation of the Grand Canyon wall structure with an airborne imaging radar.** C. Elachi and T. G. Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing of Environment*, vol. 9, Mar. 1980, p. 171-174. Contract No. NAS7-100.

The paper reports on radar images of the Grand Canyon region obtained with the Jet Propulsion Laboratory L-band (25 cm wavelength) airborne synthetic aperture radar in order to determine the capability of such a system to observe wall stratifications compared with optical sensors. Comparisons are made between these and Landsat images of the same area. Finally, it is noted that the observations do not furnish any new information on the geology of the Grant Canyon, rather, they add to the data base which is required in the interpretation of radar images from unknown remote regions such as the surface of Venus. M.E.P.

**A80-26807** **90 GHz radiometric imaging through clouds.** H. E. King (Aerospace Corp., El Segundo, Calif.). In: EASCON '79; Electronics and Aerospace Systems Conference, Arlington, Va., October 9-11, 1979, Conference Record. Volume 2.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 372-377. 7 refs.

A 90 GHz (3 mm wavelength) radiometer with a noise output fluctuation of 0.22 K (RMS), with a scanning antenna beam mirror, and the data processing system are described. Real-time radiometric imaging of terrain and man-made objects are shown. With a flight taken over optically opaque clouds, the imager was able to distinguish bridges, rivers, marshland and other landforms. Antenna temperature distributions of a variety of land targets are tabulated, and the complexity of deriving target brightness temperatures from the measured antenna temperatures are discussed. (Author)

**A80-27426** **American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings.** Edited by J. Cowsert and L. Cameron. Falls Church, Va., American Society of Photogrammetry, 1979. 293 p. Members, $5.00; nonmembers, $10.00.

The meeting focused on the observing and measuring the planet earth; data acquisition and information; surveying and remote sensing in energy and mineral source production, in the management and use of water resources, and in food and fiber production and management of natural vegetation; and marine surveying and mapping. Papers were presented on data acquisition and applications of the Landsat-D observations, Landsat-D sensor data product generation, spatial quantification of maps or images - cell size or pixel size implications, wetland flow resistance determination using Landsat data, error detection and rectification in digital terrain models, and monitoring man's impact in the coastal zone. A.T.

**A80-27427 *** **Data acquisition and projected applications of the observations from Landsat-D.** D. L. Williams and V. V. Salomonson (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 16-29. 11 refs.

The paper considers data acquisition and projected applications of the Landsat-D observations. The Landsat-D system will use communication satellites to relay sensor measurements in near-real time to ground data processing facilities. Other improvements result from advanced capabilities of the Thematic Mapper (TM) over those of the Multispectral Scanner Subsystem which include: (1) better spatial resolution; (2) narrower spectral bands in the 0.5 to 0.9 micron region and new bands covering regions from 0.45 to 2.35 microns; and (3) better radiometric resolution. These improvements in spatial, spectral, and radiometric resolution are expected to enhance the satellite applicability in agriculture, forest and rangeland, water, and land use. A.T.

**A80-29163** **Preliminary estimates of the resolution capability of the SEASAT radar altimeter.** R. F. Brammer and R. V. Sailor (Analytic Sciences Corp., Reading, Mass.). *Geophysical Research Letters*, vol. 7, Mar. 1980, p. 193-196.

This paper reports preliminary results on the capability of the SEASAT radar altimeter to resolve short wavelength geoid features. Spectral coherence calculated for pairs of repeat tracks provides an estimate of the shortest repeatable (geoid) wavelength that can be resolved in the data. Coherence is high for wavelengths longer than 70 km but is insignificant for wavelengths shorter than about 30 km. For SEASAT, oceanographic effects may be more significant than the instrument noise in limiting geoidal resolution. A parametric error model for SEASAT data based on repeat track analysis is also presented. This model will be useful for filtering or smoothing SEASAT data. (Author)

**A80-31121 #** **Aspects of the spaceborne remote sensing of the earth (Nekotorye problemy kosmicheskogo zemlevedeniia).** B. V. Vinogradov. *Akademiia Nauk SSSR, Vestnik*, no. 12, 1979, p. 86-94. In Russian.

Certain technical aspects of the remote sensing of earth resources are reviewed with emphasis on recent developments in the Soviet Union. Attention is given to such topics as thematic mapping, environmental monitoring, and remote phenology. B.J.

**A80-31987** **Systems of image data acquisition and digitization (Systèmes d'acquisition et de numérisation de données image).** J. C. Terrisson (Centre National d'Etudes Spatiales, Toulouse, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 287-318. In French.

Problems associated with the handling and recording of multispectral scanner data are examined. Signal digitization principles and equipment are reviewed, and attention is given to the CNES complete data acquisition system, which includes a quick-look system, a digitization/calibration system, and a PCM acquisition system. B.J.

**A80-31998** **Cartography and remote sensing.** F. Lagrave and M. Thonus (Matra, S.A., Division Optique, Rueil-Malmaison, Hauts-de-Seine, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 496-511.

The definition of a range of standard products capable of meeting the requirements, at the lowest possible cost, of people interested in the synthesis of remote sensing data and cartographic documents is given. The fact that data may be provided by airborne campaigns or by satellite instruments generating image data directly in digital form is taken into account. Equipment for photogrammetric restitution and a system for processing the multispectral

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remote sensing data are introduced, and general considerations on the techniques currently employed for a study of a sample of terrain are presented. O.L.

**N80-16402*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A SPECTRAL FILTER FOR ESMR'S SIDELOBE ERRORS**
Dennis Chesters Sep. 1979 26 p refs
(NASA-TM-80555) Avail: NTIS HC A03/MF A01 CSCL 08B

Fourier analysis was used to remove periodic errors from a series of NIMBUS-5 electronically scanned microwave radiometer brightness temperatures. The observations were all taken from the midnight orbits over fixed sites in the Australian grasslands. The angular dependence of the data indicates calibration errors consisted of broad sidelobes and some miscalibration as a function of beam position. Even though an angular recalibration curve cannot be derived from the available data, the systematic errors can be removed with a spectral filter. The 7 day cycle in the drift of the orbit of NIMBUS-5, coupled to the look-angle biases, produces an error pattern with peaks in its power spectrum at the weekly harmonics. About plus or minus 4 K of error is removed by simply blocking the variations near two- and three-cycles-per-week. R.E.S.

**N80-16676*#** National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
**THE ROLE OF SATELLITE ALTIMETRY IN CLIMATE STUDIES**
C. L. Parsons Washington Jan. 1980 32 p refs
(NASA-TP-1570) Avail: NTIS HC A03/MF A01 CSCL 04B

The results of three generations of satellite-borne radar altimetry experiments are summarized. The diverse measurements possible from this instrument are shown to be directly applicable to studies of the importance of the oceans in climate. The radar altimeter has unique value for investigations seeking knowledge of the interconnections between ocean dynamics, heat and momentum transfer across the air-sea interface, sea ice extent, and polar ice sheet thickness. Author

**N80-17535*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena
**SEASAT GULF OF ALASKA WORKSHOP REPORT. VOLUME 1: PANEL REPORTS**
Apr. 1979 374 p refs Workshop held at Pasadena, Calif., 22 Sep. 1979, sponsored in part by NASA Sponsored by NASA
(NASA-CR-162759, PB-300413/2, NOAA-79073114, Rept-622-101) Avail: NTIS HC A16/MF A01 CSCL 08E

The comparison of surface observations with satellite sensor data as well as the intercomparison of data from sensors measuring common geophysical parameters were covered. There is clear evidence that a real time oceanic monitoring system, patterned after the Seasat sensors, yield extremely important data for meteorology, climatology, ocean circulation, navigation, and numerous other oceanographic and geodetic applications. The salient conclusions are given, on a sensor by sensor basis. GRA

**N80-17866#** Eurosat S.A., Geneva (Switzerland).
**STUDY FOR THE DETERMINATION OF GEOMETRIC AND SPECTRAL RESOLUTION REQUIREMENTS OF OPTICAL IMAGING INSTRUMENTS FOR EARTH RESOURCES SATELLITES, VOLUME 1 Final Report**
C. L. P. Miller May 1979 65 p
(Contract ESA-3529/78-F-HS(SC))
(CM/PR/3384-Vol-1, ESA-CR(P)-1239-Vol-1) Avail: NTIS HC A04/MF A01

A study aimed at establishing optimum values of sensor related parameters is reviewed. The history is traced from the original call for ideas to the final statements of objectives and proposed methodology. Recommendations for the activation of the study are made selecting three alternatives with various levels of constraint. Author (ESA)

**N80-19589*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SMMR SIMULATOR RADIATIVE TRANSFER CALIBRATION MODEL 1: DERIVATION**
Charles D. Calhoon, Susan Link, Michael Doyle, and Brian Krupp, Principal Investigators (Systems and Applied Sciences Corp., Riverdale, Md.) Aug. 1979 67 p refs ERTS
(E80-10081; NASA-TM-80244) Avail: NTIS HC A04/MF A01 CSCL 14B

**N80-20017*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**THE REDUCTION OF REMOTE SENSING DATA BY VISUAL MEANS**
Robert N. Colwell (California Univ., Berkeley), Charles E. Poulton, and Barry J. Schrumpf (Oregon State Univ., Corvallis) *In its* Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 453-526 refs
Avail: NTIS HC A99/MF A01 CSCL 05B

Issues likely to be of concern to educators called upon to teach courses involving the reduction (interpretation) of remotely sensed data by visual means are considered. Topics covered include: (1) information requirements of those using remotely-sensed data; (2) educational concepts involved in teaching students how to generate the desired information from a visual analysis of the data; (3) principles and techniques specific to the photointerpretation process; (4) concepts involved in the making of photographic measurements, as dictated by the geometry of remote sensing imagery; (5) the nature of the various kinds of mapping, plotting, and photointerpretation equipment; and (6) some special considerations with respect to the convergence of evidence and other principles involved in the interpretation of photographs. A recommended procedure for determining the usefulness of any given type of aerial or space photography in relation to the inventory of natural resources is included. A.R.H.

**N80-20564*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
**AN INITIAL ASSESSMENT OF THE PERFORMANCE ACHIEVED BY THE SEASAT-1 RADAR ALTIMETER**
William F. Townsend Feb. 1980 41 p refs
(NASA-TM-73279) Avail: NTIS HC A03/MF A01 CSCL 14B

The results of an initial on-orbit engineering assessment of the performance achieved by the radar altimeter system flown on SEASAT-1 are presented. Additionally, the general design characteristics of this system are discussed and illustrations of altimeter data product are provided. The instrument consists of a 13.5 GHz monostatic radar system that tracks in range only using a one meter parabolic antenna pointed at the satellite nadir. Two of its unique features are a linear FM transmitter with 320 MHz bandwidth which yields a 3.125 nanosecond time delay resolution, and microprocessor implemented closed loop range tracking, automatic gain control (AGC), and real time estimation of significant wave height (SWH). Results presented show that the altimeter generally performed in accordance with its orginal performance requirments of measuring altitude to a precision of less the 10 cm RMS, significant wave height to an accuracy of + or - 0.5 m or 10%, whichever is greater, and ocean backscatter coefficient to an accuracy of + or - 1 db, all over an SWH range of 1 to 20 meters. J.M.S.

**N80-20697#** Bayerische Akademie der Wissenschaften, Munich (West Germany).
**THE EROS-DOPPLER OBSERVATION CAMPAIGN (EROS-DOC) [DIE EROS DOPPLER BEOBACHTUNGSKAMPAGNE (EROS-DOC)]**
Wolfgang Schlueter, Hermann Seeger, Gerhard Soltau, Peter Wilson, and Peter Wolf *In its* Res. Program 78, Satellite Geodesy Program 1978 p 65-71 refs In GERMAN

Avail: NTIS HC A09/MF A01
Data from the Doppler observation program (EROS-1) conducted by eight satellite observation stations are presented. The calculations are discussed in reference to the broadcast ephemeris and the precise ephemeris. Author (ESA)

**N80-20706#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**CONTRIBUTIONS TO THE CREATION OF A CONCLUSIVE SYSTEM OF CONCEPTS OF PHOTOGRAMMETRY AND AERIAL PHOTOGRAPH CARTOGRAPHY [BEITRAG ZUM AUFBAU EINES GESCLOSSENEN BEGRIFSSYTEMS DER PHOTOGRAMMETRIES UND DER LUFTBILDKARTOGRAPHIES]**
Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 7-35 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01
In connection with the revision of the German standard DIN 18 716 (photogrammetry and remote sensing) a review is presented of the conceptual connections within the fields of image recording, image processing and image evaluation as well as aerial photograph cartography, which is to serve as a contribution to the creation of a theoretical basis for photogrammetry and aerial photograph cartography. Author (ESA)

**N80-20709#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**SETTING DATA FROM MULTISTAGE ANALYTICAL ORIENTATION [EINSTELLDATEN AUS MEHRSTUFIGEN ANALYTISCHEN ORIENTIERUNGSVORGAENGEN]**
Karl Schuerer *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 71-84 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01
From the angles of rotation and the base components determined during the multistage analytical orientation, setting data for different analog plotting instruments are calculated. Preliminary experience shows that these data influences the economy of analog plotting considerably. Author (ESA)

**N80-20712#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**PRODUCTION OF COLOR COMPOSITES FORM MULTISPECTRAL DATA RECORDS [DIE HERSTELLUNG VON FARBKOMPOSITEN AUS MULTISPEKTRALAUFNAHMEN]**
Hans Peter Groetsch *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 149-160 In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01
Production techniques and applications for color composites made from multispectral images are described. The use of Diazofoils results in higher accuracy than possible with film processes. Author (ESA)

**N80-20759*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE EFFECT OF SEA STATE ON ALTIMETER MEASUREMENTS**
R. Kolenkiewicz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 187-189 refs ERTS
Avail: NTIS HC A14/MF A01 CSCL 08C

**N80-20783*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MULTISPECTRAL LINEAR ARRAY SENSOR DEVELOPMENT**
C. C. Schnetzler, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 297-298 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 14B

**N80-20784*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LINEAR ARRAY PUSHBROOM RADIOMETER DATA ANALYSIS**
J. Irons and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 299-302 ERTS

Avail: NTIS HC A14/MF A01 CSCL 14B

**N80-21002#** National Environmental Satellite Center, Washington, D. C.
**SATELLITE ACTIVITIES OF NOAA 1978**
Jun. 1979 23 p
(PB80-112782; NOAA-79100504) Avail: NTIS HC A02/MF A01 CSCL 04B
The NOAA elements that participate in the polar orbiting and geostationary satellite systems are listed with descriptions of their individual programs. Satellite data uses described include wind and temperature determination, environmental warning services, and the monitoring of ocean, hydrological, agricultural, and fishery conditions. Space support activities are also discussed. K.L.

**N80-21800#** National Environmental Satellite Service, Washington, D. C.
**METEOROLOGICAL SATELLITES: STATUS AND OUTLOOK**
D. S. Johnson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 3-14

Avail: NTIS HC A12/MF A01
The performance of the Argos and Tiros-N satellites is assessed. Data from the very high resolution radiometer aboard the Tiros-N, the altimeter, scatterometer, and the synthetic aperture radar aboard the Seasat satellite, and the scanning multichannel microwave radiometer and coastal zone color scanner aboard the Nimbus-7 are presented. Author (ESA)

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# 09
# GENERAL

**Includes economic analysis**

**A80-22376 *** **International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volumes 1, 2 & 3.** Symposium sponsored by the Environmental Research Institute of Michigan, NASA, U.S. Federal Highway Administration, DOT, et al. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979. Vol. 1, 656 p.; vol. 2, 661 p.; vol. 3, 676 p. Price of three volumes, $70.

The presentations document current activities in the field of remote sensing. Papers include those concerned with data collection, processing, and analysis hardware and methodology, as well as the application of this technology to monitoring and managing the earth's resources and man's global environment. Ground-based, airborne, and spaceborne sensor systems and both manual and machine-assisted data analysis and interpretation are considered. B.J.

**A80-22377 #** **European remote sensing activities.** P. Morel (Centre National d'Etudes Spatiales, Paris, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 3-12.

European plans for participating in earth surveys are summarized with reference to organizational matters, acquisition and processing of earth resources satellite data, and airborne remote sensing. Consideration is also given to the Meteosat program, Spacelab remote sensing instruments, the SPOT earth observation technology satellite, and certain follow-on projects. Emphasis is placed on equipment characteristics. B.J.

**A80-22378 #** **The Canadian remote sensing program.** L. W. Morley (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 13-25; Discussion, p. 27, 28.

The paper describes the activities of the Canada Centre for Remote Sensing and reviews current Canadian remote sensing projects. Particular consideration is given to: (1) lidar bathymeter experiments, (2) ERIM radar measurements, (3) Seasat surveys, (4) the Sursat program, and (5) Landsat observations. B.J.

**A80-22379 * #** **NASA policy issues.** R. A. Frosch (NASA, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 29-34; Discussion, p. 34, 35.

U.S. remote sensing policy is discussed, with emphasis on problems associated with the development of operational systems. Certain economic and legislative aspects are examined. B.J.

**A80-22419 * #** **The Landsat-D Assessment System.** P. A. Bracken, J. B. Billingsley, T. J. Lynch, and J. J. Quann (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 755-763.

The overall Landsat-D system is discussed with emphasis on the objectives, configuration, and capabilities of the Landsat-D Assessment System. This system is being developed to support investigations which demonstrate, evaluate, and assess the utility of Landsat-D data for a wide variety of earth observations applications. (Author)

**A80-22429 #** **SPOT - First French remote sensing satellite geometrical performance.** B. Cabrieres (Institut Géographique National, Saint-Mandé, Val-de-Marne, France), J. C. Cazaux, and G. Weill (Centre National d'Etudes Spatiales, Paris, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 867-877.

The paper deals with selection of the orbit parameters of the SPOT mission. The parameters are related to overall geometric and timing performance necessary for carrying out the cartographic and planimetric objectives of the mission. Consideration is given to payload characteristics, operation, and data product simulation. V.T.

**A80-22432 #** **Possibilities of optimal planning of multipurpose survey from space.** K. Ia. Kondrat'ev (Glavnaia Geofizicheskaia Observatoriia, Leningrad, USSR), A. I. Beliavskii, and O. M. Pokrovskii (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 903-910. 6 refs.

The paper discusses the problem of developing well grounded requirements for measurement instruments and conditions of surveying natural formations from space. On the basis of the factor analysis algorithm, requirements are formulated for spatial resolution, survey geometry, illumination conditions, periodicity, etc. Finally, groups and complexes of remote sensing problems which provide the most efficient agreement of the requirements with the previously mentioned parameters are determined. M.E.P.

**A80-22455 #** **Guidelines for evaluating remote sensing demonstration projects.** J. M. Sharp (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1167-1176. 23 refs.

Demonstration projects, a major part of NASA's program for remote sensing user development, are also the subject of a recent report issued by the Office of Technology Assessment (OTA). The author's experience with Landsat remote sensing demonstrations in state and local agencies is compared with the OTA guidelines, and the comparison suggests that too much is being expected from the Landsat demonstration projects. Project sponsors often must contend with conflicting goals and various inflexibilities, impecunious users with poorly-understood needs, a technology full of uncertainties, and an underdeveloped institutional environment. It is recommended that those associated with the Landsat effort lower their expectations and concentrate on ways to learn more from the demonstrations. (Author)

**A80-24051** **Remote sensing and resources management; Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Université de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings (Télédétection et gestion des ressources; Congrès, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congrès, 2nd, Université de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Comptes Rendus).** Congresses sponsored by the Association Québécoise de Télédétection, Ministère de l'Education du Québec, and Association Canadienne-Française pour l'Avancement des Sciences. Edited by F. J. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979. 269 p. In French and English. $28.

Papers are presented on the applications of remote sensing technology to resources management. Specific topics include the remote sensing of soils, water resources and vegetation, remote sensing techniques in geomorphology, the remote sensing of water resources from satellite measurements of temperature and albedo, color infrared aerial photography for the evaluation of spruce budworm damage, the utilization of thermography to detect heating losses from buildings, and new techniques for the monitoring of natural resources. A.L.W.

**N80-16401*#** National Conference of State Legislatures Denver, Colo.
**NCSL REMOTE SENSING PROJECT Final Report, 16 Jul. 1978 - 20 Sep. 1979**
Paul A. Tessar, Principal Investigator 20 Sep. 1979 88 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NASw-3230)
(E80-10053; NASA-CR-162523) Avail: NTIS HC A05/MF A01 CSCL 05B

**N80-16424*#** Illinois Inst. of Natural Resources, Springfield.
**ILLINOIS LANDSAT FEASIBILITY STUDY**
John A. Bishop Apr. 1979 94 p refs Sponsored by NASA
(NASA-CR-162760; PB-300409/0; ILLDOE-79/13) Avail: NTIS HC A05/MF A01 CSCL 22A

Satellite remote sensing technology and its application to natural resources planning and management is discussed as well as the satellite's advantages and limitations for data gathering. Recommendations for its use in Illinois are suggested. GRA

**N80-16950*** Denver Univ., Colo. Industrial Economics Div.
**SPACE BENEFITS: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY**
Jan. 1980 236 p
(Contract NASw-3113)
(NASA-CR-162697) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05A

Over 580 examples of the beneficial use of NASA aerospace technology by public and private organizations are described to demonstrate the effects of mission-oriented programs on technological progress in the United States. General observations regarding technology transfer activitiy are presented. Benefit cases are listed in 20 categories along with pertinent information such as communication link with NASA; the DRI transfer example file number and individual case numbers associated with the technology and examples used; and the date of the latest contract with user organizations. Subject, organization, geographic, and field center indexes are included. A.R.H.

**N80-17913#** Committee on Science and Technology (U. S. House).
**NASA AUTHORIZATION, 1981, PROGRAM REVIEW, VOLUME 1**
Washington GPO 1979 649 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 16-18 Oct. 1979
(GPO-53-814) Avail: Subcomm. on Space Sci. and Applications

The status of NASA programs is reviewed as a preliminary to fiscal 1981 authorization hearings. Problems of cost, performance, and scheduling which can affect the budget program performance are examined. Particular emphasis is given to advanced research and development, technology utilization, and aerospace technology transfer in communications, space processing, energy conversion, electric propulsion systems, life sciences, planetary exploration, astrophysics, solar terrestrial interactions, and Earth resources observation. A.R.H.

**N80-19893*#** South Dakota State Univ., Brookings. Remote Sensing Inst.
**REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Semiannual Progress Report, 1 Jul. - 31 Dec. 1979**
Victor I. Myers, Principal Investigator, R. G. Best, K. J. Dalsted, J. E. Eidenshink, R. Fowler, J. L. Heilman, and F. A. Schmer 31 Dec. 1979 122 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-42-003-007)
(E80-10086; NASA-CR-162784; SDSU-RSI-80-02) Avail: NTIS HC A06/MF A01 CSCL 08F

**N80-20003*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**CONFERENCE OF REMOTE SENSING EDUCATORS (CORSE-78)**
Washington Mar. 1978 664 p refs Conf. held at Stanford, Calif., 26-30 Jun. 1978
(NASA-CP-2102; A-7755) Avail: NTIS HC A99/MF A01 CSCL 05I

Ways of improving the teaching of remote sensing students at colleges and universities are discussed. Formal papers and workshops on various Earth resources disciplines, image interpretation, and data processing concepts are presented. An inventory of existing remote sensing and related subject cources being given in western regional universities is included.

**N80-20014*#** Denver Univ., Colo.
**TEXTBOOKS AND TECHNICAL REFERENCES FOR REMOTE SENSING**
Robert D. Rudd, Leonard W. Bowden (California Univ., Riverside), Robert N. Colwell (California Univ., Berkeley), and John E. Estes (California Univ., Santa Barbara) *In* NASA. Ames Res. Center Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 269-288 refs
Avail: NTIS HC A99/MF A01 CSCL 05B

A selective bibliography is presented which cites 89 textbooks, monographs, and articles covering introductory and advanced remote sensing techniques, photointerpretation, photogrammetry, and image processing. A.R.H.

**N80-20782*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LANDSAT-D ASSESSMENT SYSTEM**
D. Williams, D. Deering, K. Meehan, and J. Tucker, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 292-296 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A14/MF A01 CSCL 05B

**N80-21822*#** National Aeronautics and Space Administration, Washington, D. C.
**FINDINGS OF THE OPIT STUDY IN AMERICA**
Alain Couzy et al Mar. 1980 18 p Transl. into ENGLISH of "Mission d'Etude en Amerique," Rept-79/1564-29, Paris, Mar. - Apr. 1979 p 1-19 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National d'Etudes Spatiales (France)
(Contract NASw-3199)
(NASA-TM-76106; Rept-79/1564-29) Avail: NTIS HC A02/MF A01 CSCL 05B

The results of operational applications of American satellite remote sensing are presented. The application of data from satellites such as LANDSAT in European conditions is evaluated. J.M.S.

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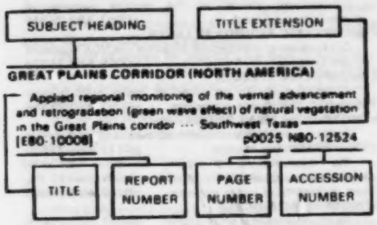
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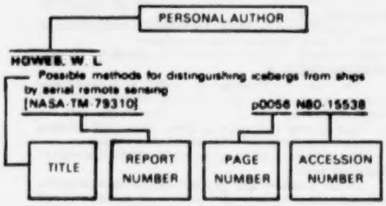

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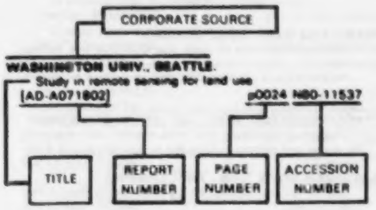

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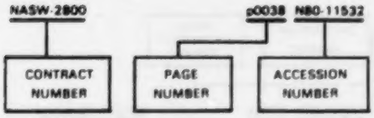

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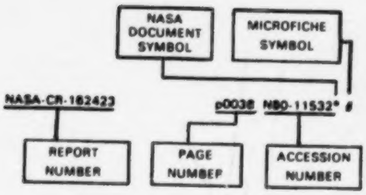

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This bibliography lists 480 reports, articles, and other documents introduced into the NASA scientific and technical information system between April 1, 1980 and June 30 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

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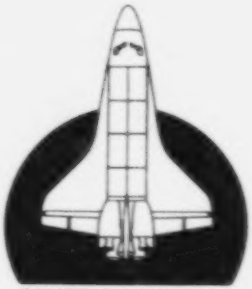

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# EARTH RESOURCES

## A Continuing Bibliography With Indexes

### Issue 27

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between July 1 and September 30, 1980 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

NASA Scientific and Technical Information Branch 1980
**National Aeronautics and Space Administration**
Washington, DC

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# INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumention on orbiting spacecraft or on aircraft.

This literature survey lists 337 reports, articles, and other documents announced between July 1 and September 30, 1980 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

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**02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES** 133

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

**03 GEODESY AND CARTOGRAPHY** 137

Includes mapping and topography.

**04 GEOLOGY AND MINERAL RESOURCES** 141

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

**05 OCEANOGRAPHY AND MARINE RESOURCES** 145

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

**06 HYDROLOGY AND WATER MANAGEMENT** 151

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

**07 DATA PROCESSING AND DISTRIBUTION SYSTEMS** 157

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

**08 INSTRUMENTATION AND SENSORS** 163

Includes data acquisition and camera systems and remote sensors.

**09 GENERAL** 169

Includes economic analysis.

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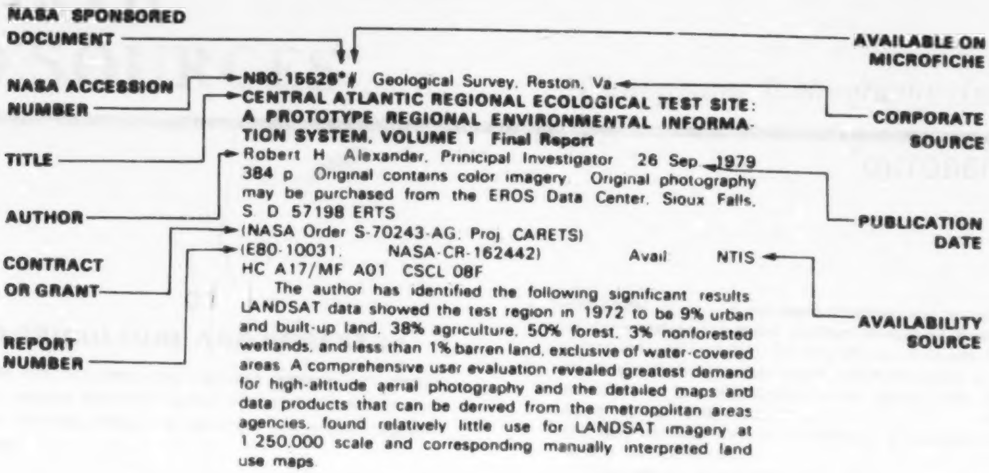
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**N80-15626*#** Geological Survey, Reston, Va.
**CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report**
Robert H. Alexander, Principal Investigator 26 Sep. 1979
384 p. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG; Proj. CARETS)
(E80-10031; NASA-CR-162442) Avail: NTIS
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The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

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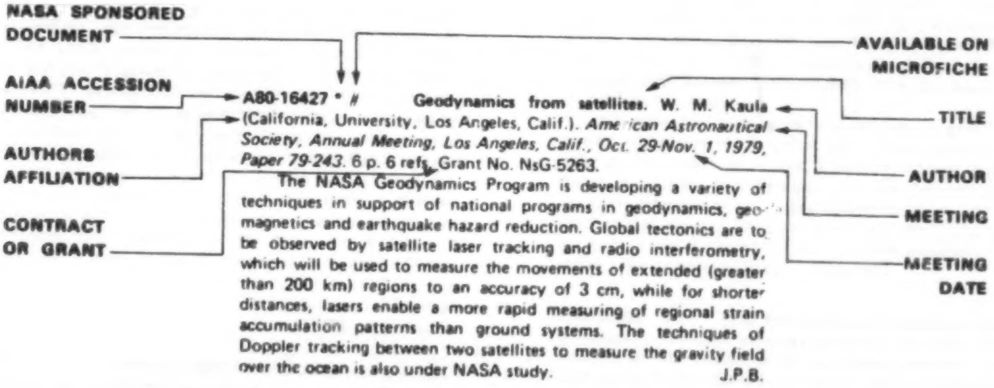
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A80-16427 * # **Geodynamics from satellites.** W. M. Kaula (California, University, Los Angeles, Calif.). *American Astronautical Society, Annual Meeting, Los Angeles, Calif., Oct. 29-Nov. 1, 1979, Paper 79-243.* 6 p. 6 refs. Grant No. NsG-5263.

The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geomagnetics and earthquake hazard reduction. Global tectonics are to be observed by satellite laser tracking and radio interferometry, which will be used to measure the movements of extended (greater than 200 km) regions to an accuracy of 3 cm, while for shorter distances, lasers enable a more rapid measuring of regional strain accumulation patterns than ground systems. The techniques of Doppler tracking between two satellites to measure the gravity field over the ocean is also under NASA study. J.P.B.

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# EARTH RESOURCES

## *A Continuing Bibliography (Issue 27)*

OCTOBER 1980

## 01

## AGRICULTURE AND FORESTRY

**Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.**

**A80-34530** # **Background survey of the operational utilization of remote sensing in agriculture (Van achtergrondsonderzoek tot operationeel gebruik van remote sensing in de landbouw).** H. W. J. van Kasteren (Centrum voor Agrobiologisch Onderzoek, Wageningen, Netherlands). *Ruimtevaart,* vol. 29, Feb. 1980, p. 84-93. In Dutch.

**A80-34538** * **Global crop forecasting.** R. B. MacDonald and F. G. Hall (NASA, Johnson Space Center, Houston, Tex.). *Science,* vol. 208, May 16, 1980, p. 670-679. 23 refs.

The needs for and remote sensing means of global crop forecasting are discussed, and key results of the Large Area Crop Inventory Experiment (LACIE) are presented. Current crop production estimates provided by foreign countries are shown often to be inadequate, and the basic elements of crop production forecasts are reviewed. The LACIE project is introduced as a proof-of-concept experiment designed to assimilate remote sensing technology, monitor global wheat production, evaluate key technical problems, modify the technique accordingly and demonstrate the feasibility of a global agricultural monitoring system. The global meteorological data, sampling and aggregation techniques, Landsat data analysis procedures and yield forecast procedures used in the experiment are outlined. Accuracy assessment procedures employed to evaluate LACIE technology performance are presented, and improvements in system efficiency and capacity during the three years of operation are pointed out. Results of LACIE estimates of Soviet, U.S. and Canadian wheat production are presented which demonstrate the feasibility and accuracy of the remote-sensing approach for global food and fiber monitoring. A.L.W.

**A80-35297** * **Airphoto analysis of erosion control practices.** K. M. Morgan, D. R. Morris-Jones, G. B. Lee, and R. W. Kiefer (Wisconsin, University, Madison, Wis.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, May 1980, p. 637-640. 8 refs. Research supported by the Wisconsin University; U.S. Environmental Protection Agency Grant No. G-005139-01; Grant No. NGL-50-002-127.

The Universal Soil Loss Equation (USLE) is a widely accepted tool for erosion prediction and conservation planning. In this study, airphoto analysis of color and color infrared 70 mm photography at a scale of 1:60,000 was used to determine the erosion control practice factor in the USLE. Information about contour tillage, contour strip cropping, and grass waterways was obtained from aerial photography for Pheasant Branch Creek watershed in Dane County, Wisconsin. (Author)

**A80-38794** # **Large space structures and the remote sensing of soil moisture (Le grandi strutture spaziali ed il telerilevamento dell'umidità del suolo).** F. Graziani (Roma, Università, Rome, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 97-106. 24 refs. In Italian.

Techniques of remote sensing from large space structures for estimating soil moisture are surveyed. The advantages of microwave sensors include greater cloud cover transparency and their apparent maintenance of sensitivity to moisture variations in the presence of a crop canopy. Since spatial resolution for microwave sensors is limited by antenna size, however, the use of large space structures for minimizing the antenna restrictions are considered. Emphasis is placed on terrain roughness, the presence of vegetation and the depth of soil penetration, as well as infrared techniques. J.P.B.

**A80-38800** # **Applications of remote sensing in agriculture (Applicazioni del telerilevamento nel campo dell'agricoltura).** F. Liguori (Consiglio Superiore dell' Agricoltura e Foreste, Rome, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 181-190. In Italian.

Prospects for applying remote sensing to agriculture are reviewed, considering the irrigation uses of water resources, the water balance, and Italian agriculture. Attention is given to agrarian and forest cultivation, hydrogeology, and the relation between the physical conditions of the vegetation and the productivity of various cultivational efforts. Also considered are the Tellus and UMUS projects, as well as the PAN project, wherein hydrologic balances are defined and evapotranspiration is measured. J.P.B.

**A80-38802** # **The European contribution to remote sensing in agriculture through the Ispra projects of the CCR (Il contributo Europeo al telerilevamento in agricoltura attraverso i progetti del CCR Ispra).** S. Galli de Paratesi (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 199-216. 29 refs. In Italian.

Remote sensing of agricultural resources is discussed, considering the AGRESTE and Tellus pilot projects. Attention is given to the identification, classification, and surface inventory of agrico-forestal land, particularly of rice fields and poplar groves. Spectral characteristics of such objects are examined, taking into account varying degrees of fertilization and density; also discussed is an attempt to forecast production using radiometric data. J.P.B.

**A80-38814** # **Green and soil brightness indicators obtained through a Landsat data transformation procedure.** A. Zandonella (Telespazio S.p.A., Rome, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 345-354. 7 refs.

A linear transformation method for the acquisition of green and soil brightness indicators from Landsat images is presented. The method is based on the structure of Landsat data in signal space, in which most of the spectral data of an agricultural region are so highly correlated that they lie in a V-shaped pattern of a plane in four-dimensional band space. Analysis of the physical basis of absorption and reflection signals in MSS bands 5 and 6 reveals one arm of the pattern to be associated with bare soil, while green vegetation lies along the other arm. Factorial analysis techniques can then be used to rotate the band space and obtain images correlated to green and soil indicators. The application of the technique to a test area is illustrated, and it is concluded that the analysis of data structure in a pictorial/geometric formulation may be used in the solution of agricultural problems. A.L.W.

**A80-39739** **Some significant results of a remote sensing experiment under European conditions /AGRESTE project/.** A. Berg and S. Galli de Paratesi (EURATOM and Comitato Nazionale per L'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). *International Journal of Remote Sensing,* vol. 1, Jan.-Mar. 1980, p. 3-9. 5 refs.

Selected results concerning northern Italian sites of the European AGRESTE project aimed at evaluating the applicability of remote sensing techniques to agriculture and forestry in Europe are presented. The identification of rice fields, poplar plantations and beech coppices was performed using supervised classification algorithms for Landsat imagery, allowing an estimation of the respective areas, and a multitemporal analysis was found to improve the classification accuracy relative to ground truth. In addition, relationships between the agronomical and radiometric characteristics in the four Landsat channels of rice were found to allow the estimation of yields before harvesting. A.L.W.

**A80-39743** * **Relationship of crop radiance to alfalfa agronomic values.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.), J. H. Elgin, Jr., and J. E. McMurtrey, III (U.S. Department of Agriculture, Field Crops Laboratory, Beltsville, Md.). *International Journal of Remote Sensing,* vol. 1, Jan.-Mar. 1980, p. 69-75. 16 refs.

Red and photographic infrared spectral data of alfalfa were collected at the time of the third and fourth cuttings using a hand-held radiometer for the earlier alfalfa cutting. Significant linear and non-linear correlation coefficients were found between the spectral variables and plant height, biomass, forage water content, and estimated canopy cover. For the alfalfa of the later cutting, which had experienced a period of severe drought stress which limited growth, the spectral variables were found to be highly correlated with the estimated drought scores. (Author)

**A80-39862** # **The possibility of using soil reflectance spectra to study soil properties (Vozmozhnosti ispol'zovaniia spektrov otrazheniia pochv dlia izucheniia ikh svoistv).** K. Ia. Kondrat'ev (Glavnaia Geofizicheskaia Observatoriia, Leningrad, USSR) and P. P. Fedchenko (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennoi Meteorologii, Obninsk, USSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 114-124. 32 refs. In Russian.

The use of remotely sensed spectral reflectance data for soil recognition and soil mapping is reviewed. The possibility of using soil spectral brightness coefficients for soil mapping is considered; quantitative relationships between soil spectral reflectance and soil composition are examined. The proposed soil identification technique is illustrated by examples of the soil mapping of the Ukraine and Moldavia. B.J.

**A80-40232** * **Calibration procedures for measurement of reflectance factor in remote sensing field research.** B. F. Robinson and L. L. Biehl (Purdue University, West Lafayette, Ind.). In: Measurements of optical radiations; Proceedings of the Seminar, San Diego, Calif., August 29, 30, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 16-26. 12 refs. Contracts No. NAS9-15466; No. NAS9-14970; No. NAS9-14016.

A means by which measurements of the optical properties of crops and soils can be knowledgeably compared from site to site and instrument to instrument is presented in detail. The definition of bidirectional reflectance factor is reviewed and discussed. Procedures for field implementation are illustrated and discussed. Spectral and goniometric properties of laboratory and field reference surfaces and typical environmental subjects serve as a basis for analysis of uncertainties introduced by differing illumination conditions. Results of a comparison of the performance of three spectrometer systems are presented and discussed. It is concluded that intelligent use of the bidirectional reflectance factor technique is an accurate and practical means to obtain the spectral, optical properties of crops and soils needed for advancements in agricultural remote sensing. (Author)

**A80-41294** # **Small-scale mapping of the post-fire dynamics of forests from aerial and space photographs (Melkomasshtabnoe kartirovanie poslepozharnoi dinamiki lesov po aerokosmicheskim snimkam).** V. V. Furiaev (Akademiia Nauk SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1980, p. 51-56. 18 refs. In Russian.

A method for studying the post-fire dynamics of forests on the basis of landscape and morphological analysis is described. It is shown that the landscape method of interpretation can be used for the detection and mapping of post-fire stages using aerial and space photographs. The preparation of post-fire maps of different scales is examined. B.J.

**A80-41304** * **The use of Landsat data to inventory cotton and soybean acreage in North Alabama.** S. W. Downs, Jr. (NASA, Marshall Space Flight Center, Data Systems Laboratory, Huntsville, Ala.) and N. L. Faust (Georgia Institute of Technology, Atlanta, Ga.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 45-63.

This study was performed to determine if Landsat data could be used to improve the accuracy of the estimation of cotton acreage. A linear classification algorithm and a maximum likelihood algorithm were used for computer classification of the area, and the classification was compared with ground truth. The classification accuracy for some fields was greater than 90 percent; however, the overall accuracy was 71 percent for cotton and 56 percent for soybeans. The results of this research indicate that computer analysis of Landsat data has potential for improving upon the methods presently being used to determine cotton acreage; however, additional experiments and refinements are needed before the method can be used operationally. (Author)

**A80-41305** * **Issues arising from the demonstration of Landsat-based technologies to inventories and mapping of the forest resources of the Pacific Northwest states.** D. L. Peterson and D. H. Card (NASA, Ames Research Center, Moffett Field, Calif.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 85-99. 13 refs.

**A80-41307 *** **Application of remote sensing techniques to study southern pine beetles in the Georgia Piedmont.** J. A. Biesbrock (North Georgia College, Dahlonega, Ga.) and S. W. Downs, Jr. (NASA, Marshall Space Flight Center, Data Systems Laboratory, Huntsville, Ala.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 115-128. 16 refs.

**A80-41308** **Forest cover mapping from Landsat imagery.** A. J. Nash (Missouri-Columbia, University, Columbia, Mo.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 129-137.

Forest cover maps were produced for the 114 counties of Missouri by interpreting Landsat imagery. The original Landsat imagery was enlarged eight times to 1:125000 to equal the scale of the county maps. Forest cover was outlined on acetate overlays and then painted black to make a negative. A printing plate was made of each county and the forest cover was over-printed in light green on the county base map. To make a map of forest cover state-wide, a PMT print of each county at a scale of 1:500000 was made. The PMT's were than mosaicked together on a state base map and a negative and printing plate were made on the composite. The state-wide map shows forest cover in a light green overprint. (Author)

**A80-41309** **Mapping hardwood forest defoliation by digital analysis of satellite data.** G. R. Johnson (Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S.D.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 139-157. 13 refs. U.S. Geological Survey Contract No. 14-08-0001-16439.

The effectiveness of digital image analysis techniques is evaluated with regard to mapping the extent and severity of hardwood-forest canopy defoliation by the gypsy moth in the northeastern U.S. from Landsat MSS data and making geometrically corrected map overlays of known accuracy. An interactive procedure employing a clustering algorithm was used to develop training statistics to classify spectral data into nonforest and forest classes that include nondefoliated hardwood forest as well as light, moderate and heavy canopy defoliation. When all defoliation classes were grouped, the classification accuracy of Landsat results for defoliation was 70.2 plus or minus 5.2%, and overall grouped classification accuracy was 86.5 plus or minus 2.3%. It was thus shown that canopy defoliation could be identified and mapped from satellite data but defoliation severity levels could not be reliably identified. J.P.B.

**A80-41310 *** **Application of remote sensing to estimating soil erosion potential.** D. R. Morris-Jones and R. W. Kiefer (Wisconsin, University, Madison, Wis.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 159-186. Grant No. NGL-50-002-127.

A variety of remote sensing data sources and interpretation techniques has been tested in a 6136 hectare watershed with agricultural, forest and urban land cover to determine the relative utility of alternative aerial photographic data sources for gathering the desired land use/land cover data. The principal photographic data sources are high altitude 9 x 9 inch color infrared photos at 1:120,000 and 1:60,000 and multi-date medium altitude color and color infrared photos at 1:60,000. Principal data for estimating soil erosion potential include precipitation, soil, slope, crop, crop practice, and land use/land cover data derived from topographic maps, soil maps, and remote sensing. A computer-based geographic information system organized on a one-hectare grid cell basis is used to store and quantify the information collected using different data sources and interpretation techniques. Research results are compared with traditional Universal Soil Loss Equation field survey methods. (Author)

**A80-41312** **Color and color infrared 70 mm aerial photography as a monitoring tool for assessing vegetation changes in a large freshwater wetland.** S. L. Wynn and R. W. Kiefer (Wisconsin, University, Madison, Wis.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 199-227. Research supported by the Wisconsin Power and Light Co., Madison Gas and Electric Co., and Wisconsin Public Service Corp.; U.S. Environmental Protection Agency Grant No. R-803971-03.

**A80-41543 *** **Complexities of nadir-looking radiometric temperature measurements of plant canopies.** D. S. Kimes (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.), S. B. Idso, P. J. Pinter, Jr., R. D. Jackson, and R. J. Reginato (U.S. Department of Agriculture, Water Conservation Laboratory, Phoenix, Ariz.). *Applied Optics*, vol. 19, July 1, 1980, p. 2162-2168. 22 refs.

Effective radiant temperatures (ERTs) of five wheat canopies in different stages of development were measured during morning and noon periods. The observed variability in nadir sensor response was quantitatively described as a function of canopy structure and the vertical temperature profile of canopy components. In many cases, the nadir sensor ERT was a poor measure of vegetation temperature due to effects of soil emissions. Strong vertical temperature profiles of vegetation components were also observed. The theory and measurements presented document that remote measurements of vegetation canopy temperatures cannot be made indiscriminately over large spatial regions without consideration of the underlying physical principles. (Author)

**A80-41664** **Photometric analysis of aerial photographs to detect and map sulfur dioxide effects of soybeans near two large, coal-fired power plants.** C. D. Sapp (Tennessee Valley Authority, Air Quality Branch, Muscle Shoals, Ala.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 9-27. 7 refs. U.S. Environmental Protection Agency Contract No. IAG-D6-E721.

**A80-41666** **Color infrared imagery as a management tool in the control of Dutch Elm Disease.** L. F. Budd (Photographic Interpretation Corp., Hanover, N.H.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 73-83. 9 refs.

**A80-41675** **Estimation of vegetation biomass in bunchgrass rangelands of Alberta using Landsat imagery.** D. Jacques and J. Cihlar (Calgary, University, Calgary, Alberta, Canada). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 227-250. 19 refs. Research supported by the Department of Energy, Mines and Resources.

**A80-41678** **Applicability of Landsat imagery for mapping soils in arid and semi-arid regions.** B. K. Worcester and K. J. Dalsted (South Dakota State University, Brookings, S. Dak.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of

Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 289-299. 13 refs.

The concept of soils as a continuum on the landscape and its relationship to Landsat imagery is presented. The USDA system of soil taxonomy is briefly discussed and its hierarchical nature is related to Landsat mapping scales. The need for careful, supporting field investigation is emphasized as it provides verification of soil classification and support for extrapolation of mapping results. (Author)

**A80-41679 *** **Influence of soils on Landsat spectral signatures of corn.** K. J. Dalsted, B. K. Worcester, and M. E. DeVries (South Dakota State University, Brookings, S. Dak.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 301-314. 17 refs. Grant No. NGL-43-003-007. (SDSU-RSI-J-78-14)

Landsat data have been investigated extensively to determine crop types and acreage. However, confounding site factors have been found to reduce accuracy. Soils data in a small, contiguous area in southeast South Dakota were used to stratify Landsat data. A June 5 and July 29 CCT were used in a statistical analysis of corn training data. Significant soil parameters causing differences in study area soils were slope and parent material. Implication of the results is that, in this region, stratification of CCT data along parent material boundaries would improve corn classification accuracy. Research expanding on the interaction of soils and crops is both in progress and scheduled for additional studies in east central South Dakota. (Author)

**A80-41680** **The relationship of soybean rust severity and yield to reflectance properties.** P. S. Casey and L. W. Burgess (Sydney, University, Sydney, Australia). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 315-322. 13 refs. Research supported by the Commonwealth Scientific and Industrial Research Organization and U.S. Department of Agriculture.

A ground-based technique was used to measure the reflectance of a soybean canopy infected with rust. An Exotech radiometer which detects the radiance in four Landsat bandpasses was mounted on the bucket of an elevated travel tower. Disease severity was assessed on the ground at the same time at which the reflectance of the canopy was measured. The degree of association between the reflectance factor and disease severity was found to be highly significant in the four preselected bandpasses. B.J.

**N80-22756*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SURVEY OF METHODS FOR SOIL MOISTURE DETERMINATION**
T. J. Schmugge, T. J. Jackson (Dept. of Agriculture, Beltsville, Md.), and H. L McKim (CRREL) Nov. 1979 76 p refs Presented at the Pecora Symp., Sioux Falls, S.D., Jun. 1979 Submitted for publication
(NASA-TM-80658) Avail: NTIS HC A05/MF A01 CSCL 08M

Existing and proposed methods for soil moisture determination are discussed. These include: (1) in situ investigations including gravimetric, nuclear, and electromagnetic techniques; (2) remote sensing approaches that use the reflected solar, thermal infrared, and microwave portions of the electromagnetic spectrum; and (3) soil physics models that track the behavior of water in the soil in response to meteorological inputs (precipitation) and demands (evapotranspiration). The capacities of these approaches to satisfy various user needs for soil moisture information vary from application to application, but a conceptual scheme for merging these approaches into integrated systems to provide soil moisture information is proposed that has the potential for meeting various application requirements. A.R.H.

**N80-23210*#** Scientific Systems, Inc., Cambridge, Mass.
**WHEAT FORECAST ECONOMICS EFFECT STUDY Final Report**
R. K. Mehra, R. Rouhani, S. Jones, and I. Schick Washington NASA May 1980 117 p refs
(Contract NAS5-25463)
(NASA-CR-3286) Avail: NTIS HC A06/MF A01 CSCL 05C

A model to assess the value of improved information regarding the inventories, productions, exports, and imports of crop on a worldwide basis is discussed. A previously proposed model is interpreted in a stochastic control setting and the underlying assumptions of the model are revealed. In solving the stochastic optimization problem, the Markov programming approach is much more powerful and exact as compared to the dynamic programming-simulation approach of the original model. The convergence of a dual variable Markov programming algorithm is shown to be fast and efficient. A computer program for the general model of multicountry-multiperiod is developed. As an example, the case of one country-two periods is treated and the results are presented in detail. A comparison with the original model results reveals certain interesting aspects of the algorithms and the dependence of the value of information on the incremental cost function. M.G.

**N80-23720*#** Lockheed Electronics Co., Houston, Tex.
**CROP PHENOLOGY LITERATURE REVIEW FOR CORN, SOYBEAN, WHEAT, BARLEY, SORGHUM, RICE, COTTON, AND SUNFLOWER**
T. Hodges and P. C. Doraiswamy, Principal Investigators Nov. 1979 90 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for Intern. Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10093; NASA-CR-160469; SR-L9-00409; LEC-13722; JSC-16088) Avail: NTIS HC A05/MF A01 CSCL 02C

**N80-23721*#** Fort Lewis A&M Coll., Durango, Colo.
**DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CROP CALENDAR MODEL Final Report**
James R. Baker, Principal Investigator 31 Dec. 1979 83 p refs ERTS
(Contract NAS9-15276)
(E80-10094; NASA-CR-160447) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. Least squares techniques were applied for parameter estimation of functions to predict winter wheat phenological stage with daily maximum temperature, minimum temperature, daylength, and precipitation as independent variables. After parameter estimation, tests were conducted using independent data. It may generally be concluded that exponential functions have little advantage over polynomials. Precipitation was not found to significantly affect the fits. The Robertson triquadratic form, in general use for spring wheat, yielded good results, but special techniques and care are required. In most instances, equations with nonlinear effects were found to yield erratic results when utilized with averaged daily environmental values as independent variables.

**N80-23725*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**AGRICULTURAL SOIL MOISTURE EXPERIMENT: 1978 COLBY (KANSAS) DATA CATALOG AND DOCUMENTATION**
B. W Milstead, Principal Investigator Sep. 1979 176 p refs ERTS
(Contract NAS9-15800)
(E80-10098; NASA-CR-160473; LEC-13226; JSC-16229) Avail: NTIS HC A09/MF A01 CSCL 02C

**N80-23726*#** Lockheed Engineering and Management Services Co Inc. Houston, Tex.
**VARIABILITY OF CROP CALENDAR STAGE DATES**
M. L. Sestak, T. Hodges, and J. A. Artley, Principal Investigators Jan. 1980 23 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10099; NASA-CR-160468; LEMSCO-14070;
SR-L0-00416; JSC-16309) Avail: NTIS HC A02/MF A01
CSCL 02C

**N80-23727*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**NATIONWIDE FORESTRY APPLICATIONS PROGRAM: CORRECTIONS TO FOREST REFLECTANCE AS A FUNCTION OF LOW SUN ANGLE AND SLOPE**
W. H. Echert and C. E. Campbell, Principal Investigators Jun. 1979 36 p refs Sponsored in part by USDA ERTS
(Contract NAS9-15800)
(E80-10100; NASA-CR-160470; LEC-13188) Avail: NTIS
HC A03/MF A01 CSCL 02F

**N80-23730*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**LANDSAT RECONNAISSANCE IMAGES OF THE GREAT SOIL REGION IN THE WESTERN PART OF THE PARAIBA BASIN [RECONHECIMENTO DOS GRANDES DOMINIOS PEDOLOGICOS DA BACIA DO PARAIBA (PARTE OCIDENTAL) ATRAVES DE IMAGENS LANDSAT]**
Nelson DeJesusParada, Principal Investigator, Mario Valerio Filho, Jose Pereira deQueirozNeto, Natalio Felipe Koffler, Paulo Nakashima, Juercio Tavares deMattos, Nilton Tocicazu Higa, and Vitor Celso deCarvalho Nov. 1979 55 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E80-10103; NASA-CR-162812; INPE-1623-RPE/088) Avail:
NTIS HC A04/MF A01 CSCL 05B

**N80-23731*#** Purdue Univ., Lafayette, Ind.
**SAMPLING FOR AREA ESTIMATION: A COMPARISON OF FULL-FRAME SAMPLING WITH THE SAMPLE SEGMENT APPROACH**
Marilyn Hixson, Marvin E. Bauer, and Barbara J. Davis, Principal Investigators (Bell Telephone Co., Indianapolis) 1979 8 p refs Presented at the Machine Process. of Remotely Sensed Data Symp., 1979 ERTS
(Contract NAS9-14970)
(E80-10104; NASA-CR-160479; Rept-06277) Avail: NTIS
HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Full-frame classifications of wheat and non-wheat for eighty counties in Kansas were repetitively sampled to simulate alternative sampling plans. Evaluation of four sampling schemes involving different numbers of samples and different size sampling units shows that the precision of the wheat estimates increased as the segment size decreased and the number of segments was increased. Although the average bias associated with the various sampling schemes was not significantly different, the maximum absolute bias was directly related to sampling size unit.

**N80-23732*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**EVALUATION OF SEVERAL SCHEMES FOR CLASSIFICATION OF REMOTELY SENSED DATA: THEIR PARAMETERS AND PERFORMANCE**
Donna Scholz, Nancy Fuhs, Marilyn Hixson, and Tsuyoshi Akiyama, Principal Investigators 1979 14 p refs ERTS
(Contract NAS9-15466)
(E80-10105; NASA-CR-160478; LARS-TR-041279) Avail:
NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Data sets for corn, soybeans, winter wheat, and spring wheat were used to evaluate the following schemes for crop identification: (1) per point Gaussian maximum classifier; (2) per point sum of normal densities classifiers; (3) per point linear classifier; (4) per point Gaussian maximum likelihood decision tree classifiers; and (5) texture sensitive per field Gaussian maximum likelihood classifier. Test site location and classifier both had significant effects on classification accuracy of small grains; classifiers did not differ significantly in overall accuracy, with the majority of the difference among classifiers being attributed to training method rather than to the classification algorithm applied. The complexity of use and computer costs for the classifiers varied significantly. A linear classification rule which assigns each pixel to the class whose mean is closest in Euclidean distance was the easiest for the analyst and cost the least per classification.

**N80-23738*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Status Report, 1 Dec. 1978 - 31 May 1979**
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 31 May 1979 32 p refs ERTS
(Grant NGL-15-005-186)
(E80-10111; NASA-CR-162853; LARS-053079) Avail: NTIS
HC A03/MF A01 CSCL 05A

**N80-23739*#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
**APPLICABILITY OF SELECTED WHEAT REMOTE SENSING TECHNOLOGY TO CORN AND SOYBEANS Final Report, 1 Nov. 1978 - 30 Nov. 1979**
Quentin A. Holmes, William A. Malila, Principal Investigators, D. P. Rice, and E. P. Crist Jan. 1980 38 p refs ERTS
(Contract NAS9-15082)
(E80-10112; NASA-CR-160546; ERIM-124000-9-F) Avail:
NTIS HC A03/MF A01 CSCL 02C

**N80-23740*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**AGRICULTURAL SCENE UNDERSTANDING AND SUPPORTING FIELD RESEARCH, VOLUME 1 Final Report, 1 Dec. 1978 - 30 Nov. 1979**
D. A. Landgrebe, Principal Investigator, M. E. Bauer, L. L. Biehl, C. S. T. Daughtry, B. F. Robinson, and E. R. Stover Nov. 1979 140 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10113; NASA-CR-160547; SR-P9-00410;
LARS-112879) Avail: NTIS HC A07/MF A01 CSCL 02C

**N80-23741*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**PROCESSING TECHNIQUES DEVELOPMENT, VOLUME 2. PART 1: CROP INVENTORY TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1979**
D. A. Landgrebe, Principal Investigator, C. S. T. Daughtry, and M. M. Hixson Nov. 1979 76 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10114; NASA-CR-160548; SR-P9-00411;
LARS-112979) Avail: NTIS HC A05/MF A01 CSCL 02C

**N80-23742*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**PROCESSING TECHNIQUES DEVELOPMENT, VOLUME 3. PART 2: DATA PREPROCESSING AND INFORMATION EXTRACTION TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1979**
D. A. Landgrebe, Principal Investigator, P. H. Swain, P. E. Anuta, and H. J. Siegel Nov. 1979 165 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10115; NASA-CR-160549; SR-P9-00412;
LARS-113079) Avail: NTIS HC A08/MF A01 CSCL 05B

**N80-23743*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**COMPUTER PROCESSING SUPPORT, VOLUME 4 Final Report, 1 Dec. 1978 - 30 Nov. 1979**
D. A. Landgrebe, Principal Investigator, J. L. Kast, L. A. Kraemer, B. M. Shelley, S. K. Schwingendorf, and T. L. Phillips Nov. 1979 136 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for Intern. Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10116; NASA-CR-160550; SR-P9-00413;
LARJ-120179) Avail: NTIS HC A07/MF A01 CSCL 02C

**N80-23744*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**CORN/SOYBEAN DECISION LOGIC: IMPROVEMENTS AND NEW CROPS**
C. L. Dailey, K. M. Abotteen, and J. D. Nichols, Principal Investigators Jan. 1980 91 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10118; NASA-CR-160543; FC-Lo-00420;
LEMSCO-14084; JSC-16301) Avail: NTIS HC A05/MF A01 CSCL 02C

**N80-23745*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**INTERPRETATION OF LANDSAT DIGITAL DATA USING A CUBIC COLOR MODEL BASED ON RELATIVE ENERGIES**
R. B. Cate, D. E. Phinney, M. C. Kinsler, M. L. Sestak, T. Hodges, and J. J. Dishler, Principal Investigators Feb. 1980 31 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10119; NASA-CR-160541; SR-L0-00418;
LEMSCO-13499) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-23746*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**NEUTRON-METER CALIBRATION FOR THE 1978 COLBY SOIL MOISTURE EXPERIMENT**
Lalit M. Arya, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10120; NASA-CR-160553; SR-L0-00415;
LEMSCO-14082; JSC-13775) Avail: NTIS HC A03/MF A01 CSCL 08M

**N80-23747*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**COMPOSITION AND ASSEMBLY OF A SPECTRAL DATA BASE FOR TRANSITION YEAR SPRING WHEAT BLIND SITES**
M. H. Trenchard, M. L. Sestak, and M. C. Kinsler, Principal Investigators Jan. 1980 114 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10121; NASA-CR-160544; SR-L0-00417;
LEMSCO-14069; JSC-16273) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-23748*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**CROP YIELD LITERATURE REVIEW FOR AGRISTARS CROPS: CORN, SOYBEANS, WHEAT, BARLEY, SORGHUM, RICE, COTTON, AND SUNFLOWERS**
P. C. Doraiswamy, T. Hodges, and D. E. Phinney, Principal Investigators Dec. 1979 106 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10122; NASA-CR-160542; SR-L9-00405; LEC-13791;
JSC-16320) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-25741*#** Canada Centre for Remote Sensing, Ottawa (Ontario).
**HCMM: SOIL MOISTURE EXPERIMENT Progress Report**
Josef Cihlar, Principal Investigator 30 Apr. 1980 4 p Sponsored by NASA HCMM
(E80-10166; NASA-CR-163183) Avail: NTIS HC A02/MF A01 CSCL 08M

**N80-26713*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MICROWAVE REMOTE SENSING OF SOIL MOISTURE CONTENT OVER BARE AND VEGETATED FIELDS 3**
J. R. Wang, J. C. Shiue, and J. E. McMurtrey, III, Principal Investigators (Agr. Res. Center, Beltsville, Md.) Mar. 1980 16 p refs Submitted for publication ERTS
(E80-10123; NASA-TM-80669) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Ground truth of soil moisture content, and ambient air and soil temperatures were acquired concurrently with measurements of soil moisture in bare fields and fields covered with grass, corn, and soybeans obtained with 1.4 GHz and 5 GHz radiometers mounted on a truck. The biomass of the vegetation was sampled about once a week. The measured brightness temperatures over the bare fields were compared with those of radiative transfer model calculations using as inputs the acquired soil moisture and temperatures data with appropriate values of dielectric constants for soil-water mixtures. A good agreement was found between the calculated and measured results over 10 deg to 70 deg incident angles. The presence of vegetation reduced the sensitivity of soil moisture sensing. At 1.4 GHz the sensitivity reduction ranged from about 20% for 10 cm tall grassland cover to over 50 to 60% for the dense soybean field. At 5 GHz corresponding reduction in sensitivity ranged from approximately 70% to approximately 90%.

**N80-26716*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA**
P. H. Swain, S. B. Vardeman, and J. C. Tilton, Principal Investigator 10 Jan. 1980 39 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Grant NSF MCS-78-04366; Proj. AgRISTARS)
(E80-10126; NASA-CR-160587; SR-P0-00443;
LARS-TR-011080) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-26717*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MONITORING FOREST CANOPY ALTERATION AROUND THE WORLD WITH DIGITAL ANALYSIS OF LANDSAT IMAGERY**
Darrel L. Williams and Lee D. Miller, Principal Investigator (Texas A and M Univ., College Station) Aug. 1979 46 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10127; NASA-TM-80761) Avail: NTIS HC A03/MF A01 CSCL 02F

**N80-26718*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**EVALUATION OF TRANSITION YEAR CANADIAN TEST SITES**
R. W. Payne, Principal Investigators Apr. 1980 36 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior

and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10128; NASA-CR-160655; FC-L0-00422;
LEMSCO-14320; JSC-16338) Avail: NTIS HC A03/MF A01
CSCL 02C

The author has identified the following significant results. The spring small grain proportion accuracy in 15 Saskatchewan test sites was found to be comparable to that of the Large Area Crop Inventory Experiment Phase 3 and Transition Year results in the U.S. spring wheat states. Spring small grain labeling accuracy was 94%, and the direct wheat labeling accuracy was 89%, despite the low barley separation accuracy of 30%.

**N80-26719*#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

**SOIL TEXTURAL EFFECTS ON RADAR RESPONSE TO SOIL MOISTURE**

Fawwaz T. Ulaby, Principal Investigator and M. C. Dobson Oct. 1979 240 p refs ERTS
(Contract NAS9-14052)
(E80-10131; NASA-CR-160585; RSL-TR-264-30) Avail: NTIS HC A11/MF A01 CSCL 08M

**N80-26721*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**PHYSIOCHEMICAL, SITE, AND BIDIRECTIONAL REFLECTANCE FACTOR CHARACTERISTICS OF UNIFORMLY MOIST SOILS**

Eric R. Stoner and Marion F. Baumgardner, Principal Investigator Feb. 1980 104 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10134; NASA-CR-160571; SR-PO-00431;
LARS-TR-11679) Avail: NTIS HC A06/MF A01 CSCL 02C

The author has identified the following significant results. The bidirectional reflectance factor (0.5 micron to 2.3 micron wavelength interval) and physiochemical properties of over 500 soils from 39 states, Brazil and Spain were measured. Site characteristics of soil temperature regime and moisture zone were used as selection criteria. Parent material and internal drainage were noted for each soil. At least five general types of soil reflectance curves were identified based primarily on the presence or absence of ferric iron absorption bands, organic matter content, and soil drainage characteristics. Reflectance in 10 bands across the spectrum was found to be negatively correlated with the natural log of organic matter content.

**N80-26722*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Oct. - 31 Dec. 1979**

R. P. Mroczynski, Principal Investigator, F. E. Goodrick, S. Schwingendorf, B. Shelley, D. Freeman, C. Kozlowski, C. Smith, and C. Peterson 20 Jan. 1980 65 p ERTS
(Contract NAS9-15325)
(E80-10135; NASA-CR-160570; LARS-CR-012080) Avail: NTIS HC A04/MF A01 CSCL 20F

**N80-26723*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**CONTEXT DISTRIBUTION ESTIMATION FOR CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA**

J. C. Tilton, P. H. Swain, and S. B. Vardeman, Principal Investigator Apr. 1980 12 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10136; NASA-CR-160588; SR-PO-00444;
LARS-TR-040280) Avail: NTIS HC A02/MF A01 CSCL 02C

**N80-26733*#** Telespazio, S.p.A., Rome (Italy).

**GREEN AND SOIL BRIGHTNESS INDICATORS OBTAINED THROUGH A LANDSAT DATA TRANSFORMATION PROCEDURE**

Angelo Zandonella, Principal Investigator 1980 11 p refs Presented at the 27th Rass. Intern. Elettronica Nucl. ed Aerospaziale, Rome, 7-16 Mar. 1980 and the 20th Convegno sullo Spazio, Rome, 11-13 Mar. 1980 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10146; NASA-CR-163164) Avail: NTIS HC A02/MF A01 CSCL 14E

**N80-26735*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

**LABEL IDENTIFICATION FROM STATISTICAL TABULATION (LIST) TEMPORAL EXTENDABILITY STUDY**

T. B. Dennis, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10148; NASA-CR-160563; SR-LO-00424;
LEMSCO-14278; JSC-16334) Avail: NTIS HC A03/MF A01
CSCL 02C

The author has identified the following significant results. The most apparent contributors to the problem of poor temporal extension of LIST are the drastic changes in the brightness keys and an inadequate set of AI responses in Phase 3. The brightness trajectories change drastically from Phase 3 to the transition year (TY). Removing brightness channels from the discriminant does not completely correct the lack of extendability. Removing brightness increases the accuracy of the extension from Phase 3 to TY from 57.7 percent to 64.18 percent. The removal of the AI keys increases accuracy to 65.76 percent. Although the latter increase appears insignificant when compared to the first, the removal of only the AI keys increased accuracy to 63.58 percent. Proper weighting of the responses explains 73.8 percent of the ground truth labels but only 56.7 percent of the AI labels. By contrast, the TY responses which were weighted to explain the TY ground truth labels fared equally well, explaining 73.6 percent of those labels and 87.1 percent of the AI labels.

**N80-26740*#** Texas A&M Univ., College Station. Remote Sensing Center.

**DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report**

W. D. Rosenthal, J. C Harlan, and Bruce J. Blanchard, Principal Investigator Feb. 1980 24 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24383)
(E80-10157; NASA-CR-163174; PR-3712-8) Avail: NTIS HC A02/MF A01 CSCL 02C

**N80-26741*#** Dartmouth Coll., Hanover, N.H.

**AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Jul. - 31 Dec. 1979**

Richard W. Birnie, Richard E. Stoiber, Principal Investigator, Emily Bryant, A. G Dodge, Ken Sutherland, Joseph Francica, and Lawrence Malinconico 31 Dec. 1979 27 p ERTS
(Grant NsG-5014)
(E80-10158; NASA-CR-163177) Avail: NTIS HC A03/MF A01 CSCL 08F

**N80-26742*#** Montana Univ., Missoula. Wildlife-Wildlands Inst.

**GRIZZLY BEAR HABITAT ANALYSIS. SECTION 2: EVALUATION OF GRIZZLY BEAR FOOD PLANTS, FOOD CATEGORIES AND HABITAT**

John J. Craighead and Jay S. Sumner, Principal Investigator 1980 172 p refs Sponsored by NASA ERTS
(E80-10159; NASA-CR-163175) Avail: NTIS HC A08/MF A01 CSCL 08F

**N80-27099#** International Training Centre for Aerial Survey, Enschede (Netherlands).
**DIGITAL IMAGE PROCESSING OF SATELLITE PHOTOGRAPHS [DIGITALE BEELDVERWERKING VAN SATELLIET OPNAMEN]**
Nico H. W. Donker *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 35-61 refs In DUTCH

Avail: NTIS HC A06/MF A01

The significance of remote sensing for developing countries is emphasized, and some applications mentioned, using LANDSAT data in particular. Also discussed are digital imagery, geometric and radiometric corrections, and automatic classification of soil cover using multispectral data. Author (ESA)

**N80-27565#** Army Engineer Topographic Labs., Fort Belvoir, Va.
**BACKSCATTERING OF ELECTROMAGNETIC WAVES FROM A LAYER OF VEGETATION**
Richard A. Hevenor 15 Feb. 1980 29 p refs
(AD-A083922; ETL-R008) Avail: NTIS HC A03/MF A01 CSCL 17/9

A theoretical model for the backscattering of electromagnetic waves from a layer of vegetation is computed using a first order renormalization technique to determine volume scattering. The vegetation soil interface is assumed rough according to the tangent plane approximation and the scattering from this boundary is added incoherently to the volume scattering result. The mean wave in the vegetation is obtained using a bilocal approximation of the Dyson's equation. A free space dyadic Green's function is used along with a correlation function of the dielectric fluctuations which is exponential in form and which also possess different correlation lengths lx, ly, and lz in the x, y, and z, directions. Effective propagation constants are obtained for both horizontal and vertical polarizations. The scattered wave is solved for using a two dimensional Fourier transform technique and the boundary conditions at either end of the vegetation layer are matched. The far field backscatter coefficients are computed for both horizontal and vertical polarizations. The mean and variance of the dielectric fluctuations are calculated with the aid of Peake's model for the dielectric constant of vegetation. The theory is matched to experimental data taken from a corn field. The resulting values for the correlation parameters are then used to monitor the growth pattern of the corn field over a period of time. Comparison between the theoretical and experimental results over this time period are shown. The theory is also matched to experimental data from spring and fall deciduous trees. GRA

**N80-27764*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**LABEL IDENTIFICATION FROM STATISTICAL TABULATION (LIST)**
T. B. Dennis, Principal Investigator Mar. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10132; NASA-CR-160584; SR-LO-00430; LEMSCO-14390; JSC-16345) Avail: NTIS HC A02/MF A01 CSCL 02C

**N80-27765*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**ON THE ACCURACY OF PIXEL RELAXATION LABELING**
D. A. Landgrebe, Principal Investigator, J. A. Richards, and P. H. Swain Mar. 1980 34 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10185; NASA-CR-160691; SR-PO-00455; LARS-TR-030180) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-27766*#** Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
**DATA RESOLUTION VERSUS FORESTRY CLASSIFICATION**
Edwin P. F. Kan and David L. Ball, Principal Investigators Dec. 1974 34 p refs Sponsored in part by USDA ERTS
(Contract NAS9-12200)
(E80-10189; NASA-CR-160610) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-27767*#** Environmental Research Inst. of Michigan, Ann Arbor.
**ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES**
**Quarterly Progress Report, 16 Feb. - 15 May 1980**
Robert Horvath, R. Cicone, E. Crist, R. Kauth, and W. Pont, Principal Investigators May 1980 142 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10191; NASA-CR-160692; ERIM-132400-40-P) Avail: NTIS HC A07/MF A01 CSCL 05B

**N80-27769*#** Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
**FINAL DESIGN SPECIFICATION FOR LARSYS/ISOCLS MODIFICATION FOR LACIE PHASE 3**
B. F. Wills, Principal Investigator Feb. 1977 70 p ERTS
(Contract NAS9-12200)
(E80-10212; NASA-CR-160612; LEC-10161; JSC-12542) Avail: NTIS HC A04/MF A01 CSCL 05B

**N80-27770*#** Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
**TRANSFER OF INTERACTIVE REPORT EXTRACTED DATA (TIRED) REQUIREMENTS SPECIFICATION**
Kenneth L. Pattison, Principal Investigator Jun. 1976 10 p ERTS
(Contract NAS9-12200)
(E80-10219; NASA-CR-160615; LEC-8841; JSC-11365) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-27771*#** Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
**TRANSFER OF INTERACTIVE REPORT EXTRACTED DATA (TIRED) REQUIREMENTS SPECIFICATION**
Kenneth L. Pattison, Principal Investigator Jun. 1976 10 p ERTS
(Contract NAS9-12200)
(E80-10221; NASA-CR-160611; LEC-8841-Rev-A; JSC-11365-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-27772*#** Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
**PDP 11/45 LACIE PHASE 11/111 AUTOMATIC STATUS AND TRACKING SYSTEM FUNCTIONAL DESIGN SPECIFICATION**
J. M. Everette and D. L. Smith, Principal Investigators Nov. 1976 53 p ERTS
(Contract NAS9-12200)
(E80-10222; NASA-CR-160613; LEC-9861; JSC-11835) Avail: NTIS HC A04/MF A01 CSCL 02C

**N80-27774*#** Lockheed Electronics Co., Houston, Tex.
**SCREWWORM ERADICATION DATA SYSTEM, PHASE 2 PROJECT PLAN: FIELD TESTS**
Aug. 1975 15 p ERTS
(Contract NAS9-12200)
(E80-10225; NASA-CR-160616; LEC-6473; JSC-09825) Avail: NTIS HC A02/MF A01 CSCL 08C

**N80-27780*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REMOTE SENSING OF SOIL MOISTURE CONTENT OVER BARE FIELDS AT 1.4 GHz FREQUENCY**

J. R. Wang and B. J. Choudhury (Computer Sciences Corp., Silver Spring, Md.) Jun. 1980 26 p refs Submitted for publication
(NASA-TM-80711) Avail: NTIS HC A03/MF A01 CSCL 08M

A simple method of estimating moisture content (W) of a bare soil from the observed brightness temperature (T sub B) at 1.4 GHz is discussed. The method is based on a radiative transfer model calculation, which has been successfully used in the past to account for many observational results, with some modifications to take into account the effect of surface roughness. Besides the measured T sub B's, the three additional inputs required by the method are the effective soil thermodynamic temperature, the precise relation between W and the smooth field brightness temperature T sub B and a parameter specifying the surface roughness characteristics. The soil effective temperature can be readily measured and the procedures of estimating surface roughness parameter and obtaining the relation between W and smooth field brightness temperature are discussed in detail. Dual polarized radiometric measurements at an off-nadir incident angle are sufficient to estimate both surface roughness parameter and W, provided that the relation between W and smooth field brightness temperature at the same angle is known. The method of W estimate is demonstrated with two sets of experimental data, one from a controlled field experiment by a mobile tower and the other, from aircraft overflight. The results from both data sets are encouraging when the estimated W's are compared with the acquired ground truth of W's in the top 2 cm layer. An offset between the estimated and the measured W's exists in the results of the analyses, but that can be accounted for by the presently poor knowledge of the relationship between W and smooth field brightness temperature for various types of soils. An approach to quantify this relationship for different soils and thus improve the method of W estimate is suggested.
L.F.M.

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# 02

# ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

**Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.**

**A80-35302 *** **Utilizing LANDSAT imagery to monitor land-use change - A case study in Ohio.** S. I. Gordon (Ohio State University, Columbus, Ohio). *Remote Sensing of Environment*, vol. 9, May 1980, p. 189-196. 9 refs. Research supported by the U.S. Department of Housing and Urban Development; Contract No. NAS5-22399.

A study, performed in Ohio, of the nature and extent of interpretation errors in the application of Landsat imagery to land-use planning and modeling is reported. Potential errors associated with the misalignment of pixels after geometric correction and with misclassification of land cover or land use due to spectral similarities were identified on interpreted computer-compatible tapes of a portion of Franklin County for two adjacent days of 1975 and one day of 1973, and the extents of these errors were quantified by comparison with a ground-checked set of aerial-photograph interpretations. The open-space and agricultural categories are found to be the most consistently classified, while the more urban areas were classified correctly only from about 43 to 8% of the time. It is thus recommended that the direct application of Landsat data to land-use planning must await improvements in classification techniques and accuracy. A.L.W.

**A80-35303 *** **Remote sensing and spectral analysis of plumes from ocean dumping in the New York Bight Apex.** R. W. Johnson (NASA, Langley Research Center, Hampton, Va.). *Remote Sensing of Environment*, vol. 9, May 1980, p. 197-209. 20 refs.

The application of the remote sensing techniques of aerial photography and multispectral scanning in the qualitative and quantitative analysis of plumes from ocean dumping of waste materials is investigated in the New York Bight Apex. Plumes resulting from the dumping of acid waste and sewage sludge were observed by Ocean Color Scanner at an altitude of 19.7 km and by Modular Multispectral Scanner and mapping camera at an altitude of 3.0 km. Results of the qualitative analysis of multispectral and photographic data for the mapping, location, and identification of pollution features without concurrent sea truth measurements are presented which demonstrate the usefulness of in-scene calibration. Quantitative distributions of the suspended solids in sewage sludge released in spot and line dumps are also determined by a multiple regression analysis of multispectral and sea truth data. A.L.W.

**A80-35746 #** **Remote sensing applications to wind power facility siting.** C. L. Rosenfeld and P. A. Maule (Oregon State University, Corvallis, Ore.). In: Conference and Workshop on Wind Energy Characteristics and Wind Energy Siting, Portland, Ore., June 19-21, 1979, Proceedings. Boston, Mass., American Meteorological Society, 1979, p. 375-379.

The application of remote sensing techniques to the assessment of potential wind power sites according to various indicators is discussed. The key wind-power indicators are grouped as vegetation, snow covers, eolian features and topoclimatic indicators, and each group is matched with appropriate sensing platforms and parameters to be used in regional assessment, area evaluation and specific site selection. Procedures for initial regional-scale screening based on regional wind field data and satellite imagery and high-altitude aerial photographs and for medium-scale evaluation based on vertical aerial photography supplied by various agencies and unconventional photointerpretation techniques such as vegetation deformation and electronic image processing are examined. Aerial or field reconnaissance efforts are then presented as appropriate means for the verification of specific candidate sites for wind instrumentation.
A.L.W.

**A80-36470 *** **A survey of light-scattering techniques used in the remote monitoring of atmospheric aerosols.** D. Deirmendjian (Rand Corp., Santa Monica, Calif.). *Reviews of Geophysics and Space Physics*, vol. 18, May 1980, p. 341-360. 165 refs. Contract No. NAS6-2697.

A critical survey of the literature on the use of light-scattering mechanisms in the remote monitoring of atmospheric aerosols, their geographical and spatial distribution, and temporal variations was undertaken to aid in the choice of future operational systems, both ground based and air or space borne. An evaluation, mainly qualitative and subjective, of various techniques and systems is carried out. No single system is found to be adequate for operational purposes. A combination of earth surface and space-borne systems based mainly on passive techniques involving solar radiation with active (lidar) systems to provide auxiliary or backup information is tentatively recommended. (Author)

**A80-38803 #** **Regional requirements and prospects for the use of remote sensing for the management of territory (Esigenze delle regioni e prospettive dell'uso del telerilevamento per il governo del territorio).** P. Mussio (Servizio Informatica, Milan, Italy) and P. Rigamonti. In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings.
Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 217-229. 24 refs. In Italian.

The use of remotely sensed satellite data for agricultural as well as urban territorial management and resources management is discussed. Attention is given to the proper interpretation and utilization of the data received, and to the use of a systematic survey which can be repeated periodically. Italian regional proposals in this regard are outlined, including the identification of experimental polygons, the constitution of observation centers, the institution of standard instruments and criteria, and the systematic presentation of experimental results. J.P.B.

**A80-39212 *** **Overview of the NASA tropospheric environmental quality remote sensing program.** F. Allario, W. G. Ayers, and J. M. Hoell (NASA, Langley Research Center, Hampton, Va.). In: Atmospheric effects on radiative transfer; Proceedings of the Seminar, San Diego, Calif., August 29, 30, 1979.
Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 72-86. 36 refs.

This paper will summarize the current NASA Tropospheric Environmental Quality Remote Sensing Program for studying the global and regional troposphere from space, airborne and ground-based platforms. As part of the program to develop remote sensors for utilization from space, NASA has developed a series of passive and active remote sensors which have undergone field test measurements from airborne and ground platforms. Recent measurements with active lidar and passive gas filter correlation and infrared heterodyne techniques will be summarized for measurements of atmospheric aerosols, CO, SO2, O3, and NH3. These measurements provide the data base required to assess the sensitivity of remote sensors for applications to urban and regional field measurement programs. Studies of Earth Observation Satellite Systems are currently being performed by the scientific community to assess the capability of satellite imagery to detect regions of elevated pollution in the troposphere. The status of NASA sponsored research efforts in interpreting satellite imagery for determining aerosol loadings over land and inland bodies of water will be presented, and comments on the potential of these measurements to supplement in situ and airborne remote sensors in detecting regional haze will be made.
(Author)

## 02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

**A80-39217 *** **Comparison of stack plume properties obtained from aircraft and spacecraft measurements.** W. F. Staylor (NASA, Langley Research Center, Marine and Applications Technology Div., Hampton, Va.). In: Atmospheric effects on radiative transfer; Proceedings of the Seminar, San Diego, Calif., August 29, 30, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 119-124. 5 refs.

Landsat II imagery data and aircraft nephelometer measurements were analyzed to determine the quantitative properties of a stack plume emitted from a moderate-sized pulpmill. Aircraft measurements were obtained at several heights across the plume at 1.0, 3.0, and 6.5 km downwind from the stack, and for comparative purposes, the Landsat data were also analyzed at these same three locations and at 0.5 and 10.0 km. Overlapping, consecutive-day MSS data provided plume/no-plume radiances upwelling from the stack site. Imagery data from a 10- by 10 km region in the vicinity of the mill were normalized to correct for atmospheric, solar, and viewing angle differences for the 2 observation days, and cloud-shadow data were used to evaluate sky radiance. Particle concentrations, vertical and lateral dispersions, and plume heights determined from both the aircraft and spacecraft measurement techniques are in good agreement. (Author)

**A80-39705** **Environmental change detection in digitally registered aerial photographs.** W. Frei, T. Shibata, and G. C. Huth (Southern California, University, Marina del Rey, Calif.). In: Applications of digital image processing III; Proceedings of the Seminar, San Diego, Calif., August 27-29, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 26-31. 9 refs.

Digital image matching permits analysis of aerial photographs for subtle changes that are not visible to the unaided eye. These changes can be portrayed in pictorial form - a 'change image' - which provides a cost effective early indicator of impending environmental problems. The digital image matching problems encountered in low altitude aerial photographs are studied here, and examples are shown of this method applied to environmental assessment studies.

(Author)

**A80-39851 #** **Problems associated with the investigation of the natural environment from manned spacecraft (Problemy issledovaniia prirodnoi sredy s pilotiruemykh kosmicheskikh korablei).** B. V. Vinogradov (Akademiia Nauk SSSR, Institut Okeanologii, Leningrad, USSR) and V. I. Sevast'ianov. *Issledovanie Zemli iz Kosmosa*, Jan.-Feb. 1980, p. 14-24. 22 refs. In Russian.

Recent Soviet research dealing with the remote sensing of the earth's surface from manned spacecraft is reviewed. Particular attention is given to visual observations, spectrophotometry, and monospectral and multispectral photography performed from the Soyuz and Salyut spacecraft. The use of spacecraft images in agriculture is emphasized; economic factors are discussed. B.J.

**A80-40974** **Investigation of pollutant concentration distribution over areas of high population density (Untersuchung der Schadstoffkonzentrationsvertailung über Ballungsgebieten).** D. Paffrath, W. Peters (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhoffen, West Germany), and R. Strauss (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen; Bayerisches Landesamt für Umweltschutz, Munich, West Germany). *DFVLR-Nachrichten*, June 1980, p. 41-46. In German.

The use of aircraft to investigate horizontal and vertical concentration distribution of pollutants in the atmosphere is described. It is shown that in this manner it is possible to determine the horizontal distribution of a surface of about 800 sq km within an hour. The discussion covers possible applications for environmental protection, measurement techniques, and examples of some measurement results. M.E.P.

**A80-41295 #** **Orbital and sensor parameters of remote sensing satellite systems (Parametry orbit i datchikov sistemy IPRZ).** N. S. Ramm, A. M. Kuzina, and I. G. Mal'tseva (Vsesoiuznoe Nauchno-Proizvodstvennoe Ob'edinenie Aerogeologiia, Laboratoriia Aerometodov, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1980, p. 57-65. 8 refs. In Russian.

The orbits of remote sensing satellites (Landsat and Meteor) are examined in relation to the period of earth-surface photography, the number of orbital paths, and the time of passage through the ascending node of the orbit. Simple and sufficiently rigorous formulas are derived for the dependence of orbital height and inclination on these parameters. In addition, relationships between the orbital parameters and sensor parameters are examined. The formulas obtained make it possible to simplify ballistic calculations for various systems as well as to evaluate different system designs from the user's point of view. B.J.

**A80-41317 *** **Determination of the properties of a power-plant plume by aircraft and spacecraft measurements.** W. F. Staylor (NASA, Langley Research Center, Marine and Applications Technology Div., Hampton, Va.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 329-341.

**A80-41672** **Utilization of night time aerial thermography in mapping temperature inversion areas.** F. Boon (Shebrooke, Université, Sherbrooke, Quebec, Canada) and J. Lévesque. In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 181-197. 7 refs.

Data obtained over Quebec show that thermal infrared remote sensing is a very efficient tool for the mapping of temperature inversion areas. The utilization of nighttime aerial thermography in the 8-14 micron range allows a recognition of areas where the cold air tends to accumulate during inversion conditions. The mapping of inversion sites from thermograms requires the following steps: (1) selecting the appropriate scale of imagery, (2) differentiating the thermal patterns due to microclimate from the patterns related to variations in surface materials or land use, and (3) establishing a probability scale for night frost on crops according to climatic conditions in the geographic test area. B.J.

**A80-41834** **Land use mapping by means of multitemporal Landsat-MSS data (Landnutzungskartierung mit multitemporalen Landsat-MSS-Daten).** J. Lichtenegger (Zürich, Universität, Zurich, Switzerland) and K. Seidel (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland). *Bildmessung und Luftbildwesen*, vol. 48, July 1, 1980, p. 123-131. 9 refs. In German.

A detailed mapping of land-use catagories for a selected area within the test site 'Grosses Moos', accomplished by using multispectral data (MSS) of the Landsat earth resources and technology satellite, is described. The digital data from several passes over the area were combined into a multitemporal set. It is shown how five data sets were brought into exact registration using digital correlation and combined into a single 20 channel data set. In this manner, all the land use categories could be separated and the percentage in area denoted to each was determined on this data with the help of stepwise, linear discriminant analysis (supervised classification).

M.E.P.

**N80-22938#** World Meteorological Organization Geneva (Switzerland).

**WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM-SATELLITE SUB-SYSTEM. INFORMATION ON THE APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ROUTINE OPERATIONS AND RESEARCH:**

**ABSTRACTS, ANNUAL SUMMARIES AND BIBLIOGRAPHIES**
1979 158 p refs
(WMO-475) Avail: NTIS HC A08/MF A01

The titles, abstracts and other relevant information for 59 papers contributed by 14 nations to the World Weather Watch-Global observing system program are presented, in relation to meteorological satellite data applications. Author (ESA)

**N80-23722*#** Council of State Governments, Lexington, Ky.
**INTEGRATED USE OF LANDSAT DATA FOR STATE RESOURCE MANAGEMENT**
William G. Schneider, Jr., Principal Investigator 1979 41 p refs ERTS
(Contract NASw-3140)
(E80-10095; NASA-CR-162809) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-23728*#** National Governors Association/Council of State Planning Agencies, Washington, D. C.
**LANDSAT'S ROLE IN STATE COASTAL MANAGEMENT PROGRAMS**
Oct. 1979 18 p Sponsored by NASA ERTS
(E80-10101; NASA-CR-162810) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-23729*#** National Governors Association/Council of State Planning Agencies, Washington, D. C.
**LANDSAT'S ROLE IN HUD 701 PROGRAMS**
Oct. 1979 15 p Sponsored by NASA ERTS
(E80-10102; NASA-CR-162811) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-23756#** University of Southern California, Marina del Rey. Medical Imaging Sciences Group.
**REMOTE SENSING FOR GEOTHERMAL ENVIRONMENTAL ASSESSMENTS Final Report**
W. Frei, T. Shibata, and G. C. Huth 30 Jun. 1979 35 p refs
Sponsored in part by California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15108) Avail: NTIS HC A03/MF A01

The role of remote sensing is examined in the context of the DOE Environmental Assessment Studies. Particular attention is paid to the exploitation by computer analysis, of low altitude aerial photographs, which were made available for this project. One technique, change detection, developed during this project, was found to be particularly useful because it permits the detection of environmental changes at a very early stage where it might escape detection on the ground. This technique, which was perfected for use on a routine basis, can thus provide a very effective environmental early warning capability. Several examples are shown in known Geothermal Resource Areas (KGRA's) in the Imperial Valley and the Geysers, California, which lead to the conclusion that remote sensing become an essential tool for the Environmental Assessment Studies. DOE

**N80-23764#** Economics, Statistics and Cooperatives Service, Washington, D. C. Natural Resources Economics Div.
**INTERPRETING LAND USE CHANGE THROUGH SATELLITE IMAGERY**
Linda K. Lee Dec. 1979 24 p refs
(PB80-127277; AER-442) Avail: NTIS HC A02/MF A01 CSCL 08B

Employing a multiperiod approach to monitor land use change may compound the problems associated with interpretation of satellite imagery. Data from satellite imagery were used to inventory new cropland development in the Great Plains and 85 counties in the Southeastern Alluvium Coast and Tidewater region between 1972 and 1976. Cloud cover problems, intensified by the two-period approach used, made data more difficult to interpret. Field checks were also more difficult because of the scattered and irregularly shaped land use change sites. GRA

**N80-23929#** Meteorology Research, Inc., Altadena, Calif.
**CHARACTERIZATION OF VISIBILITY-REDUCING AEROSOLS IN THE SOUTHWEST. PROJECT VISTA Final Report, 1-10 Oct. 1977**
Edward S. Macias, Donald L. Blumenthal, Jerry A. Anderson, and Bruce K. Cantrell Nov. 1979 68 p refs
(Contract EPA-68-02-2713)
(PB80-139041; MRI-78-IR-1585; EPA-600/7-79-243) Avail: NTIS HC A04/MF A01 CSCL 04A

The atmospheric visibility-reducing aerosol in the Southwest was experimentally characterized with respect to particle size composition, and contribution to light scattering. Measurements were taken within the mixing layer using the instrumented Beechcraft Queen Air aircraft. The aircraft was equipped to measure and record on magnetic tape the light-scattering coefficient, Aitken nuclei count, size distribution, ozone, sulfur dioxide, nitrogen oxides, temperature, dew point, turbulence, pressure (altitude), and navigational parameters. Multistage impactor and size-fractionated filter samples were also collected in order to determine aerosol elemental composition as a function of size. Visual range estimates were obtained by viewing distant landmarks and verified by optical photography. GRA

**N80-25735*#** Mississippi State Univ., Mississippi State.
**APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 Nov. 1979 - 30 Apr. 1980**
W. Frank Miller, Bradley D. Carter, Nancy Freeman, Jimmy L. Solomon, and Sidney G. Williams, Principal Investigators 1 May 1980 133 p refs ERTS
(Grant NGL-25-001-054)
(E80-10153; NASA-CR-163170; SAPR-13) Avail: NTIS HC A07/MF A01 CSCL 05B

**N80-25736*#** Telespazio, S.p.A., Rome (Italy).
**AN AUTOMATIC CLASSIFICATION METHOD FOR LANDSAT DATA AS RESULTING FROM DIFFERENT EXPERIENCES IN THE ITALIAN ENVIRONMENT**
Angelo Zandonella, Principal Investigator 1979 15 p refs
Presented at the 2nd Congr. Nazl. sul Telerilevamento delle Risorse Terrestri, Varenna, Italy, 1979 Sponsored by NASA ERTS
(E80-10160; NASA-CR-163176) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-25737*#** Columbia Univ., New York. Dept. of Geography.
**APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGRO-ENVIRONMENTAL STUDIES Final Report**
Robert A. Lewis and Samuel N. Goward, Principal Investigators 1 Mar. 1980 14 p ERTS
(Grant NsG-5080)
(E80-10161; NASA-CR-163178) Avail: NTIS HC A02/MF A01 CSCL 02C

**N80-25740*#** Pennsylvania State Univ., University Park. Dept. of Meteorology.
**APPLICATION OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report, 1 Dec. 1979 - 31 May 1980**
Toby N. Carlson, Principal Investigator 1 Dec. 1979 4 p HCMM
(Contract NAS5-24264)
(E80-10165; NASA-CR-163182; QR-8) Avail: NTIS HC A02/MF A01 CSCL 13B

**N80-25765#** Colorado State Univ., Fort Collins. Dept. of Earth Resources.
**APPLICATIONS OF REMOTE SENSING TO EMERGENCY MANAGEMENT Final Report, 15 May 1979 - 15 Feb. 1980**
William E. Marlatt and E. Bruce Jones (Resources Consultants, Inc., Fort Collins, Colo.) 15 Feb. 1980 61 p
(Contract DCPA01-79-C-0258)
(AD-A082243) Avail: NTIS HC A04/MF A01 CSCL 14/5

Contents: foundations of remote sensing: data acquisition and interpretation; availability of remote sensing technology for disaster response: imaging systems, current and near future satellite and aircraft remote sensing systems; utilization of remote sensing in disaster response: categories of disasters, phases of monitoring activities; recommendations for utilization of remote sensing technology in disaster response; selected reading. GRA

**N80-26015#** National Environmental Satellite Service, Washington, D. C.
**ENVIRONMENTAL SATELLITE IMAGERY**
May 1979 100 p refs
(PB80-153356; NOAA-80021221) Avail: NTIS
HC A05/MF A01 CSCL 04B

Current cloud data obtained by NOAA's operational environmental satellites is described. Daily global satellite imagery in condensed form is presented as a guide to data stored in the NOAA archive, and is designed to assist users in selecting data for research and climatological use. GRA

**N80-26736*#** Pennsylvania State Univ., University Park. Dept. of Meteorology.
**APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report**
Toby N. Carlson, Principal Investigator 1 Jun. 1980 4 p HCMM
(Contract NAS5-24264)
(E80-10150; NASA-CR-163167; QR-10) Avail: NTIS
HC A02/MF A01 CSCL 13B

**N80-26892#** National Inst. of Public Health, Bilthoven (Netherlands).
**AERIAL DETERMINATION OF LONG RANGE TRANSPORT**
T. Schneider *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 17-23 refs

Avail: NTIS HC A19/MF A01

Two series of sampling flights over the Netherlands are described; the first measuring the transport of air pollution over sea (from Great Britain), the second studying the interaction of ozone with other pollutants. Levels of SO2 were found to vary greatly with altitude. Air masses transported over land were found to contain less ozone than those arriving over the sea. The source of the ozone is open to question, but the concentrations correlate with plant damage data. Author (ESA)

**N80-26965#** AeroVironment, Inc., Pasadena, Calif.
**OZONE AND PRECURSOR TRANSPORT INTO AN URBAN AREA: EVALUATION OF MEASUREMENT APPROACHES Final Report**
Michael W. Chan, Douglas W. Allard, and Ivar Tombach Dec. 1979 166 p refs
(Contract EPA-68-02-[illegible])
(PB80-153927; EPA-450/4-79-039) Avail: NTIS
HC A08/MF A01 CSCL 13B

Five techniques for measuring the transport of ozone and precursors into an urban area are evaluated. The techniques were tested in Philadelphia during the summer of 1978. The data collected in the field program indicate that, in general, advection of ozone aloft is the main route by which pollution of photochemical interest is transported into Philadelphia. Transport of ozone along the surface and transport of oxides of nitrogen and non-methane hydrocarbons, both aloft and along the surface, are minimal. Thus, the recommended techniques must primarily be able to quantify the ozone transported aloft. Of the five techniques, three were determined applicable for quantifying the ozone transported aloft. GRA

**N80-27734#** World Meteorological Organization, Geneva (Switzerland).
**CLIMATE AND CLIMATE MODELING Final Report**
B. W. Boville *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 14-18

Avail: NTIS HC A10/MF A01

The problems of monitoring global climate and assessing climatic trends are reviewed. The use of satellite observations in the development of mathematical climatic models is considered. Various international data collection programs are cited. Numerical weather prediction is emphasized. In relation to man and his impact on the global environment, the problem of fluctuations in the level of atmospheric CO2 is treated. In conclusion, data requirements regarding climate modeling are specified. Author (ESA)

**N80-27752#** Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
**OZONE MONITORING FROM SPACE**
A. Ghazi *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 143-151 refs

Avail: NTIS HC A10/MF A01

Different methods of ozone observation by satellite are reviewed. A summary of the analyzed satellite ozone date is given. The importance of atmospheric ozone in influencing climate is emphasized based on the theoretical and observational knowledge obtained to date. Future needs of measurements and research priorities are briefly outlined. Author (ESA)

**N80-27757#** Centre National d'Etudes Spatiales, Paris (France). Paris Univ. (France).
**A VIEW ON OUTSTANDING EXPERIMENTAL PROBLEMS IN SPACE OBSERVATION FOR METEOROLOGY AND CLIMATOLOGY**
P. Morel *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 185-188 Prepared jointly with Paris Univ.

Avail: NTIS HC A10/MF A01

The application of meteorological satellite observation resources to climatology and related problems is discussed. Data needs include measurements on the radiation balance, the radiation effects of extended cloudiness, heat and moisture transport determinations, sea surface measurements, and ice processes observations. Emphasis is on possible European contributions to gathering this data. Author (ESA)

# 03

# GEODESY AND CARTOGRAPHY

Includes mapping and topography.

**A80-32689** **The geopotential from gravity measurements, levelling data and satellite results.** W. Bosch and K. R. Koch (Bonn, Universität, Bonn, West Germany). *Bulletin Géodésique*, vol. 54, no. 1, 1980, p. 73-79. 11 refs.

The geodetic boundary value problem is formulated which uses as boundary values the differences between the geopotential of points at the surface of the continents and the potential of the geoid. These differences are computed by gravity measurements and levelling data. In addition, the shape of the geoid over the oceans is assumed to be known from satellite altimetry and the shape of the continents from satellite results together with three-dimensional triangulation. The boundary value problem thus formulated is equivalent to Dirichlet's exterior problem except for the unknown potential of the geoid. This constant is determined by an integral equation for the normal derivative of the gravitational potential which results from the first derivative of Green's fundamental formula. The general solution, which exists, of the integral equation gives besides the potential of the geoid the solution of the geodetic boundary value problem. In addition approximate solutions for a spherical surface of the earth are derived. (Author)

**A80-34846** **Mapping from aerial photographs.** C. D. Burnside (North East London Polytechnic, London, England). London, Granada Publishing, Ltd., 1979. 316 p. 108 refs. $39.50.

The theoretical principles of producing topographic maps from aerial photographs are described, with emphasis on the mathematical concepts of map construction and the theoretical elements of photogrammetry. Topics covered include the geometry of the aerial photograph, graphical and photographic methods of map production, heights from parallax measurements, stereoscopic models, analog plotting instruments, analog aerial triangulation, analytical photogrammetry, the formation and adjustment of blocks, and ground control. B.J.

**A80-34857** **Maps and air photographs /2nd edition/.** G. C. Dickinson (Leeds University, Leeds, England). New York, Halsted Press, 1979. 359 p. 126 refs. $39.95.

The principles, history, and utilization of maps and aerial photography are introduced. The gradual extension and development of world mapping is traced against a background of increasing demand and the overcoming of technical obstacles, with aerial photography treated as a recent contributory factor to the ease and extension of mapping. The content and form of maps are examined, and examples of international and national map series are presented. Some of the basic problems that maps and aerial photographs can be used to resolve and techniques for resolving them are described, with attention given to map scales, position determination, area measurement, the enlargement, reduction, amending and copying of maps, accounting for the third dimension, maps as historical records, and the physical and human geographic information obtainable from maps and aerial photographs. A.L.W.

**A80-37725 *** **Gravity anomalies near the east Pacific rise with wavelengths shorter than 3300 km recovered from GEOS-3 satellite-to-satellite Doppler tracking data.** J. G. Marsh (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, Md.), B. D. Marsh (Johns Hopkins University, Baltimore, Md.), T. D. Conrad, W. T. Wells, and R. G. Williamson (EG & G Washington Analytical Services Center, Inc., Riverdale, Md.). In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 296-342. 22 refs.

**A80-37727** **Global combination of altimeter data with gradients and other potential and gravity information.** E. Groten and H. Schaab. In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978.

Athens, National Technical University of Athens, 1979, p. 369-380. 5 refs.

In the present paper, statistical considerations are used in combination with boundary value problem methods to solve the problem of satellite altimetry. The disturbing potential of the earth is determined by combined application of terrestrial (or other) gravity anomalies and satellite altimetry data. V.P.

**A80-37728 *** **Gravity anomaly and geoid undulation results in local areas from GEOS-3 altimeter data.** R. H. Rapp (Ohio State University, Columbus, Ohio). In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 381-392. 7 refs. Research supported by the Ohio State University Research Foundation; Contract No. NAS6-2484.

The adjusted GEOS-3 altimeter data, taken as averages within a data frame, have been used to construct free air anomaly and geoid undulation profiles and maps in areas of geophysical interest. Profiles were constructed across the Philippine Trench (at a latitude of 6 deg) and across the Bonin Trench (at a latitude of 28 deg). In the latter case an anomaly variation of 443 mgals in 143 km was derived from the altimeter data. These variations agreed reasonably with terrestrial estimates, considering the predicted point accuracy was about + or - 27 mgals. An area over the Patton Sea mounts was also investigated with the altimeter anomaly field agreeing well with the terrestrial data except for the point directly over the top of the sea mount. It is concluded that the GEOS-3 altimeter data is valuable not only for determining 5 deg and 1 deg x 1 deg mean anomalies, but also can be used to describe more local anomaly variations. (Author)

**A80-37729** **The ocean geoid deduced from GEOS-3 satellite radar altimetry data.** R. J. Anderle (U.S. Navy, Naval Surface Weapons Center, Dahlgren, Va.). In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 393-413. 15 refs.

The radar altimeter on board the GEOS-3 satellite, launched 9 April 1975, has provided sufficient data to map the ocean geoid at a 100 km or smaller grid size to approximately one meter accuracy between latitudes of + or - 65 degrees. The geoidal undulation computed from altimeter data are highly reproducible on repeated tracks across the same region and show excellent correlation with bathymetric features. The altimetric heights have a precision of 60 cm at a 0.1 second sample interval (0.7 km in horizontal spacing). Since the satellite position is computed to only 1.5 m accuracy vertically from ground tracking data, orbit biases are estimated and corrected by analysis of the differences in geoid heights computed at the intersections of satellite tracks. An alternative method to reduce the geoid uncertainty due to orbit error is the correction of orbit parameters to find a best fit of the altimetric geoid to a low order reference geoid. (Author)

**A80-37730 *** **Estimation of mean sea surfaces in the North Atlantic, the Pacific and the Indian Ocean using GEOS-3 altimeter data.** J. G. Marsh (NASA, Goddard Space Flight Center, Geodynamics Branch, Greenbelt, Md.), T. V. Martin, J. J. McCarthy, and P. J. Chovitz (EG & G Washington Analytical Services Center, Inc., Riverdale, Md.). In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International

Symposium, Athens, Greece, May 29-June 2, 1978.
Athens, National Technical University of Athens, 1979, p. 414-447. 10 refs.

The sea surface heights above the reference ellipsoid were determined for several regions of the world's ocean using data from the radar altimeter on board the GEOS-3 satellite in conjunction with precise orbital position information derived from laser data. The resolution of the estimated sea surfaces varied from 0.25 degrees off the east coast of the United States to about 2 degrees in the Indian Ocean near Australia. The rms crossover discrepancy after adjustment varied from 30 cm to 70 cm depending on geographic location. Comparison of the altimeter derived mean sea surface in the North Atlantic with the 5 x 5 ft GEM-8 detailed gravimetric geoid indicated a relative consistency of better than one meter. V.L.

**A80-37731 *** **Dynamic sea surface topography from GEOS-3 altimetry - Determination of some dominant parameters.** R. S. Mather, F. J. Lerch (NASA, Goddard Space Flight Center, Geodynamics Branch, Greenbelt, Md.), C. Rizos, E. G. Masters, and B. Hirsch. In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 448-477. Research supported by the Australian Research Grants Committee; Grant No. NsG-5225.

The second, third and fourth degree zonal harmonics of the quasi-stationary dynamic sea surface topography can be recovered from the GEOS-3 altimetry despite the adverse levels of noise indicated by the crossover discrepancies generated from the best orbits available at the end of 1977 and the GEOS-3 altimetry. Techniques for modelling the global sea surface topography are discussed along with methods for signal recovery in the presence of significant levels of noise. The analysis also provides a means of defining the geocentricity of the system of reference used in preparing the GEOS-3 ephemeris. (Author)

**A80-37732** **Studies of the GEOS 3 altimeter derived geoid undulations over seamounts in the Indian Ocean.** A. Cazenave, K. Dominh (Centre National d'Etudes Spatiales, Groupe de Recherches de Géodésie Spatiale, Toulouse, France), and K. Lambeck (Australian National University, Canberra, Australia). In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 478-499. 30 refs.

Methods of estimating the flexural rigidity, which is a measure of the resistance of the lithosphere to deformation, and which can be deduced from loading studies of the lithosphere by ice layers, sediment deposits, and marine volcanos (seamounts) are reviewed. It is shown that GEOS 3 radar altimeter observations are particularly useful in that they permit rapid sampling of geoid undulations over the oceans with good spatial resolution and a precision within 50 to 100 cm. The theory of radar altimeter observations is examined, along with the application of such observations to some features in the southern Indian Ocean. V.P.

**A80-39100** **On the compensation mechanism of the Walvis Ridge.** C. L. Angevine and D. L. Turcotte (Cornell University, Ithaca, N.Y.). *Geophysical Research Letters*, vol. 7, June 1980, p. 477-479. Contract No. N00014-79-C-0569.

The broad topographic features associated with the Walvis Ridge in the south Atlantic Ocean have been found to correlate well with the geoid anomalies obtained from the direct determination of sea surface height by the GEOS 3 satellite. It is shown that the topography of the Walvis Ridge is compensated by a Pratt-type mechanism with a depth of compensation between 20 and 30 km. The results obtained from this study, together with the results of other researchers, indicate that a variety of seafloor features may be caused by density anomalies in the upper mantle. V.L.

**A80-39858 #** **Mapping from space in the USSR (Kosmicheskaia kartografiia v SSSR).** I. A. Kutuzov (Glavnoe Upravlenie Geodezii i Kartografii, Moscow, USSR) and Iu. P. Kienko (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, Moscow, USSR). *Issledovanie Zemli iz Kosmosa*, Jan.-Feb. 1980, p. 79-87. In Russian.

The advantages of remotely sensed space data for making and revising topographic and thematic maps are reviewed. Special methods for the complex mapping of natural resources are described. B.J.

**A80-40618** **All-Union Anniversary Conference on Scientific Problems of Geodesy, Moscow, USSR, May 24-26, 1979, Proceedings (Iubileinaia Vsesoiuznaia Konferentsiia po Nauchnym Problemam Geodezii, Moscow, USSR, May 24-26, 1979, Materialy).** *Geodeziia i Aerofotos'emka*, no. 1, 1980. 133 p. In Russian.

The papers deal with some relatively recent results in the fields of geodesy, aerial photography, and cartography. The topics covered include a review of the current status and trends of geodesy in the light of modern requirements, a discussion of military contributions of scientific and applied geodesy, and an analysis of some scientific aspects of geodesy. V.P.

**A80-40619 #** **Space geodesy and aspects of geodesy theory (Kosmicheskaia geodeziia i voprosy teorii v geodezii).** M. M. Mashimov (Voenno-Inzhenernaia Akademiia, Moscow, USSR). *(Iubileinaia Vsesoiuznaia Konferentsiia po Nauchnym Problemam Geodezii, Moscow, USSR, May 24-26, 1979.) Geodeziia i Aerofotos'emka*, no. 1, 1980, p. 54-64. 8 refs. In Russian.

Recent advances in space geodesy are reviewed. Consideration is given to the determination of harmonic coefficients and gravity anomalies from satellite observations; the development of Doppler tracking techniques is emphasized. The three-dimensional model of the earth's metric and the determination of the earth's figure from space-geodetic observations are also examined. B.J.

**A80-40620 #** **Scientific problems of space geodesy (Nauchnye problemy kosmicheskoi geodezii).** V. P. Vasil'ev and M. S. Urmaev (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *(Iubileinaia Vsesoiuznaia Konferentsiia po Nauchnym Problemam Geodezii, Moscow, USSR, May 24-26, 1979.) Geodeziia i Aerofotos'emka*, no. 1, 1980, p. 70-75. In Russian.

Some of the principal aspects of space geodesy, such as the determination of the fundamental geodetic constants, improvement of models of the external gravitational field and the figure of the earth, and the construction of global three-dimensional geodetic networks are reviewed. Methods of determining the parameters characterizing satellite motion, constructing models of the forces which keep a satellite in orbit, and determining the coordinates of points of observation are examined. Laser and radio-interferometer applications in space geodesy are discussed. V.P.

**N80-26743*#** Applied Science Associates, Inc., Apex, N. C.
**A STUDY OF GEOS-3 TERRAIN DATA WITH EMPHASIS ON RADAR CROSS SECTION Final Report**
R. W. Priester May 1980 53 p refs
(Contract NAS6-2810)
(NASA-CR-156865) Avail: NTIS HC A04/MF A01 CSCL 08B

**Rader cross sections (RCS) of terrain are studied using GEOS 3 radar altimeter data. Maps of RCS for portions of four east coast states (U.S.A.) are presented and used to draw curves of RCS versus inland distance as measured from the land/sea interface. The results show RCS to decay approximately exponentially with inland distance. The GEOS 3 data are also used to develop curves of RCS seasonal variation for the same regions. Observed variations correlate strongly with local potential evaporation. Results also show that farming operations in the state of North Carolina are observable in the RCS data. A restricted method for determining surface roughness features from saturated**

average return waveforms for some types of terrain is developed. Sensor bias induced by receiver saturation for certain terrain returns is briefly discussed. J.M.S.

**N80-27732*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**GEOID ANOMALIES IN THE VICINITY OF SUBDUCTION ZONES**

David C. McAdoo May 1980 48 p refs Submitted for publication

(NASA-TM-80678) Avail: NTIS HC A03/MF A01 CSCL 08E

The regional geoid of the southwest Pacific is matched reasonably well by results from a model of the upper mantle density structure (including slabs) associated with subduction zones of the region. Estimates of the geoid are obtained from Geos-3 and Seasat radar altimeter data. These data are very well suited to the task of detecting intermediate wavelength (600-4000 km) geopotential variations. Actually, subducting slabs can be expected to produce primarily intermediate and longer wavelength variations. Gravimetric profiles across trench/island arc complexes resolve primarily short wavelengths. The model represents subducting slabs as thin surfaces of anomalous mass per unit area. These surfaces are positioned using published seismicity results which detail the configuration of the Benioff zones. Crustal effects are ignored. Effects due to the contrast between the young thermal lithosphere of the behind-arc regions (marginal basins) and the older lithosphere seaward of the trench are modelled. Results indicate that the New Hebrides slab possesses an average areal density anomaly of about 300,000 gm/sq cm. This is about three times that which is estimated for the Tonga-Kermadec slab. Additional modelling suggests that slabs worldwide may be an important source of large, long wavelength gravity highs; i.e., they may contribute substantially to geopotential power of harmonic degree as low as three or four up to twenty or more. Author

**N80-27782*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

**AIRBORNE LASER TOPOGRAPHIC MAPPING RESULTS FROM INITIAL JOINT NASA/US ARMY CORPS OF ENGINEERS EXPERIMENT**

W. B. Krabill, J. G. Collins (Army Corps of Engineers, Vicksburg, Miss.), R. N. Swift (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.), and M. L. Butler (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) Jun. 1980 36 p

(NASA-TM-73287) Avail: NTIS HC A03/MF A01 CSCL 08B

Initial results from a series of joint NASA/US Army Corps of Engineers experiments are presented. The NASA Airborne Oceanographic Lidar (AOL) was exercised over various terrain conditions, collecting both profile and scan data from which river basin cross sections are extracted. Comparisons of the laser data with both photogrammetry and ground surveys are made, with 12 to 27 cm agreement observed over open ground. Foliage penetration tests, utilizing the unique time-waveform sampling capability of the AOL, indicate 50 cm agreement with photogrammetry (known to have difficulty in foliage covered terrain). Author

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## 04

## GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

**A80-35306 *** **Optimum thermal infrared bands for mapping general rock type and temperature from space.** Q. A. Holmes, D. R. Nüesch (Michigan, Environmental Research Institute, Ann Arbor, Mich.), and R. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). *Remote Sensing of Environment*, vol. 9, May 1980, p. 247-263. 18 refs. Contract No. NAS9-15362. NASA Task 2.

A study was carried out to determine quantitatively the number and location of spectral bands required to perform general rock type discrimination from spaceborne imaging sensors using only thermal infrared measurements. Beginning with laboratory spectra collected under idealized conditions from relatively well-characterized homogeneous samples, a radiative transfer model was used to transform ground exitance values into the corresponding spectral radiance at the top of the atmosphere. Taking sensor noise into account, analysis of these data revealed that three 1 micron wide spectral bands would permit independent estimations of rock type and sample temperature from a satellite infrared multispectral scanner. This study, which ignores the mixing of terrain elements within the instantaneous field of view of a satellite scanner, indicates that the location of three spectral bands at 8.1-9.1, 9.5-10.5, and 11.0-12.0 microns, and the employment of appropriate preprocessing to minimize atmospheric effects makes it possible to predict general rock type and temperature for a variety of atmospheric states and temperatures. (Author)

**A80-37736** **Space techniques as a part of crustal dynamic monitoring networks in earthquake zones.** A. Vogel (Berlin, Freie Universität, Berlin, West Germany). In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 564-570. 25 refs.

The use of space systems in the monitoring of crustal dynamics in earthquake zones for the investigation of earthquake dynamics and prediction is discussed. Presently used techniques for crustal dynamics monitoring are considered, including the analysis of seismograms, observations of rock fractures and strain accumulation from acoustic emissions at microearthquake stations, measurements of variations in crustal elasticity and magnetic and electrical properties, strainmeters, high-precision terrestrial geodetic measurements, stress measurements and relative or absolute gravity measurements. It is argued that space techniques such as artificial satellite and lunar laser ranging and long-baseline interferometry from extragalactic sources should be combined with terrestrial methods in order to obtain a better understanding of slow-motion dynamics in selected areas of seismotectonic activity, and an example of such a system is presented. A.L.W.

**A80-38801 #** **Contribution of remote sensing to the geological problems of the country (Contributo del telerilevamento ai problemi geologici del paese).** R. Cassinis (Società Italiana per il Telerilevamento, Milan, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 191-198. 19 refs. In Italian.

The relationship between data observed by remote sensing and by other methods is considered with regard to geological exploration. Geological objectives of remote sensing include the study of geodynamic problems, structures favoring the accumulation of hydrocarbons, and the search for minerals and subterranean water. The application of remote sensing to geological problems in Italy has resulted in the relocation of historical epicenters of earthquakes and the definition of active seismic lines; and remote sensing is also used to search for geothermal energy and active volcanoes. Attention is given to the study of seismicity in Italy and the exploration for surface thermal inertia within the HCMM experiment. J.P.B.

**A80-38815 #** **Electronic photointerpretation, using digital processing, for applications in structural geology (Fotointerpretazione elettronica, mediante l'impiego di elaboratori digitali, per applicazioni nel settore geologico strutturale).** C. M. Marino and L. Vescovo (Milano, Università, Milan, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 355-362. 6 refs. In Italian.

In order to evaluate the contribution of spacecraft data in the field of structural geology, research was conducted in the Apennines. The work utilized Landsat CCT for the enhancement of the structural image information content and the automatic tracing of the features. The method considered is based on the concept of reflectivity anomaly and detects ranges of linearity. Attention is given to the type of support (analog or digital), the passages and bands to be analyzed, and to the contribution in the interpretative phase of optoelectronic processing. Also considered is the possibility of using automatic or semiautomatic processing for the tracing of elements. J.P.B.

**A80-39855 #** **Space data and geological research (Kosmicheskaia informatsiia i geologicheskie issledovaniia).** V. N. Briukhanov (Vsesoiuznoe Aerogeologicheskoe Nauchno-Proizvodstvennoe Ob'edinenie Aerogeologiia, Moscow, USSR) and V. M. Moralev (Akademiia Nauk SSSR, Institut Litosfery, Moscow, USSR). *Issledovanie Zemli iz Kosmosa*, Jan.-Feb. 1980, p. 49-54. 18 refs.

The application of remotely sensed space imagery to the interpretation of geological features is considered; a review of the literature is given. It is shown that the most important structural features which can be revealed in space images are different types of lineaments and lineament patterns as well as ring structures. The distribution of mineral deposits is shown to be correlated with lineaments and ring structures. B.J.

**A80-41292 #** **Current aspects of the development of remote sensing techniques for geological studies (Sovremennye aspekty razvitiia distantsionnykh metodov geologicheskikh issledovanii).** V. B. Komarov (Vsesoiuznoe Aerogeologicheskoe Nauchno-Proizvodstvennoe Ob'edinenie Aerogeologiia, Laboratoriia Aerometodov, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1980, p. 28-33. In Russian.

Remote sensing methods of geological exploration are reviewed, with attention given to sidelooking radar, infrared, and multispectral techniques. The need for developing computer processing of various remote sensing data is emphasized, and it is noted that the most successful application of remote sensing to geology may be achieved by examining the relationship between geological and landscape features in different parts of the electromagnetic spectrum. B.J.

**A80-41293 #** **The use of space photogeological maps for the prediction of ore deposits (Ispol'zovanie kosmofotogeologicheskikh kart pri prognoze rudnykh raionov).** M. A. Beloborodov and V. S. Kogen (Vsesoiuznoe Aerogeologicheskoe Nauchno-Proizvodstvennoe Ob'edinenie Aerogeologiia, Moscow, USSR). *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1980, p. 34-43. In Russian.

The basic principles of space photogeological mapping are reviewed, and methods for using geological, geophysical, and space photogeophysical data for the prediction of ore deposits are described. Some examples of the photogeological mapping of the Soviet Union are examined. (Author)

**A80-41674** **An inventory of peatlands in northeastern Ohio using Landsat imagery.** R. Craig, M. Dougherty, and M. Schmidt (Kent State University, Kent, Ohio). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 215-225. 10 refs.

Of the major sources of energy available in the United States, peat ranks second only to coal in total Btu's. However, in the exploitation of peat as an energy resource, the United States has lagged far behind other countries. The present paper proposes that Landsat imagery be used to create a countrywide inventory of peat deposits and attempts to demonstrate (using northeastern Ohio as an example) the feasibility of such a project. Certain basic standards for the precision of such an inventory are recommended. B.J.

**A80-43361 *** **Middle infrared multispectral aircraft scanner data - Analysis for geological applications.** A. B. Kahle, D. P. Madura, and J. M. Soha (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Applied Optics,* vol. 19, July 15, 1980, p. 2279-2290. 19 refs. Contract No. NAS7-100.

Multispectral middle IR (8-13 microns) data were acquired with an aircraft scanner over Utah. Because these digital image data were dominated by temperature, all six channels were highly correlated. Extensive processing was required to allow geologic photointerpretation based on subtle variations in spectral emittance between rock types. After preliminary processing, ratio images were produced and color ratio composites created from these. Sensor calibration and an atmospheric model allowed determination of surface brightness, temperature, emittance, and color composite emittance images. The best separation of major rock types was achieved with a principal component transformation, followed by a Gaussian stretch, followed by an inverse transformation to the original axes. (Author)

**N80-23735*#** Consiglio Nazionale delle Ricerche. Milan (Italy). Istituto per la Geofisica della Litosfera.
**STUDY OF GEOLOGICAL STRUCTURE OF SICILY AND OTHER ITALIAN AREAS Progress Report**
Robert Cassinis, Giovanni Maria Lechi, Principal Investigators, Pietro Alessandro Brivio, Renzo Moretti, and Eugenio Zilioli Jan. 1980 9 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771 Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10108; NASA-CR-162819; RN-304; PR-2) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-23736*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**INTEGRATED SURVEYS OF THE NATURAL RESOURCES IN THE AMAZONIA NATIONAL PARK (TOPAJOS) BASED ON LANDSAT IMAGES [LEVANTAMENTO INTEGRADO DOS RECURSOS NATURAIS DA AREA DO PARQUE NACIONAL DA AMAZONIA (TAPAJOS), BASEADO NAS IMAGENS MSS DO LANDSAT]**
Nelson deJesusParada, Principal Investigator, Joaquim Henrique Duran Pinto, Joao Roberto dosSantos, Liu Chan Chiang, Madalena Niero, Sergio dosAnjos Ferreira Pinto, and Vitor Celso deCarvalho Sep. 1979 59 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color illustrations ERTS
(E80-10109; NASA-CR-162820; INPE-1577-RPE/074) Avail: NTIS HC A04/MF A01 CSCL 08F

**N80-24737#** LKB Resources, Inc., Huntingdon Valley, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY, COLORADO-ARIZONA AREA: SALTON SEA NI 2-9, PHOENIX NI 12-7, EL CENTRO NI 2-12, AJO NI 12-10, LUKEVILLE NH 12-1 QUADRANGLES. VOLUME 1: NARRATIVE REPORT**
Nov. 1979 258 p refs
(Contract EY-76-C-12-1664)
(GJBX-12(80)-Vol-1) Avail: NTIS HC A12/MF A01

A rotary-wing reconnaissance high sensitivity radiometric and magnetic survey, encompassing several 1:250,000 quadrangles in southwestern Arizona and southeastern California, was performed. The surveyed area consisted of approximately 9300 line miles. The radiometric data were corrected and normalized to 400 feet terrain clearance. The data were identified as to rock type by correlating the data samples with existing geologic maps. Statistics defining the mean and standard deviation of each rock type are presented as listings in volume 1 of this report. The departure of the data from its corresponding mean rock type is computed in terms of standard deviation units and is presented as computer listings in microfiche form. The local geology is described, and the magnetic and radiometric data is discussed and selected uranium anomalies are evaluated. DOE

**N80-25733*#** Geological Survey, Denver, Colo.
**GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Dec. 1979 - Feb. 1980**
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Feb. 1980 3 p Sponsored by NASA HCMM
(E80-10151; NASA-CR-163168) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-25738*#** Stanford Univ., Calif. Dept. of Geology.
**HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA**
Ernest I. Rich, Principal Investigator 21 Apr. 1980 2 p HCMM
(Contract NAS5-24479)
(E80-10163; NASA-CR-163180) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Empirical observations on the ground and examination of aerial color IR photographs indicate that in grassland terrain, the vegetation overlying sandstone tends to become less vigorous sooner in the late spring season than does the area overlain by an adjacent shale unit. The reverse relationship obtains in the fall. These relationships are thought to be a reflection of the relative porosity of each of the units and hence of their ability to retain or lose soil moisture. A comparison of the optically enlarged day and nite IR imagery of the Late Mesozoic interbedded sandstone and shale units along the western margin of the Sacramento Valley, California, taken at seasonally critical times of the year (late spring/early summer and late fall/early winter) reveals subtle seasonal variations of graytone which tend to support the empirical observations after consideration of Sun angle and azimuth, and the internal consistency of the data on each set of satellite imagery.

**N80-25770*#** New Mexico Univ., Albuquerque. Technology Applications Center.
**REMOTE SENSING APPLIED TO PETROLEUM AND MINERAL EXPLORATION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Dec. 1979**
Robert W. Gonzales Feb. 1980 34 p Sponsored by NASA and NTIS
(NASA-CR-163311; PB80-804800) Avail: NTIS HC $30.00/MF $30.00 CSCL 08I

The use of LANDSAT Satellites and other remote sensing methods used in petroleum and mineral exploration is discussed in 118 abstracts. Topics covered include mineral deposits, oil exploration, petroleum operations, geomorphology, resources management, thematic mapping, photogeology, photomapping and photointerpretation and imaging and digital techniques. GRA

**N80-25776#** Geological Survey, Reston, Va.

**U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT, SEQUOIA, KINGS, CANYON NATIONAL PARK, CALIFORNIA. PROJECT NO. 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN**

Janet Bonner, comp. 1980 12 p refs
(PB80-147291) Avail: NTIS HC A02/MF A01 CSCL 08F

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest, cover, water area, and other diagnostic landscape features. Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

**N80-26728*#** London Univ. (England). Dept. of Geography.

**HCMM AND LANDSAT IMAGERY FOR GEOLOGICAL MAPPING IN NORTHWEST QUEENSLAND**

M. M. Cole and D. J. Edmiston, Principal Investigator [1980] 7 p refs Sponsored by NASA HCMM
(E80-10141; NASA-CR-163159) Avail: NTIS
HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Photographic prints made from negatives of day-visible and day-IR cover of selected areas were compared with enhanced color composites generated from LANDSAT computer compatible tapes and films. For geological mapping purposes, HCMM imagery is of limited value. While large scale features like the Mitakoodi anticlinorium, contrasting lithological units, and major structures may be distinguished on day-visible and day-IR cover, the spectral bands are too broad and the resolution too coarse even for regional mapping purposes. The imagery appears to be most useful for drainage studies. Where drainage is seasonal, sequential imagery permits monitoring of broad scale water movement while the day-IR imagery yields valuable information on former channels. In plains areas subject to periodic change of stream courses, comparable IR cover at a larger scale would offer considerable potential for reconstruction of former drainage patterns essential for the correct interpretation of geochemical data relative to mineral exploration.

**N80-26729*#** London Univ. (England).

**HCMM IMAGERY FOR THE DISCRIMINATION OF ROCK TYPES, THE DETECTION OF GEOTHERMAL ENERGY SOURCES AND THE ASSESSMENT OF SOIL MOISTURE CONTENT IN WESTERN QUEENSLAND AND ADJACENT PARTS OF NEW SOUTH WALES AND SOUTH AUSTRALIA Progress Report**

Monica M. Cole, Principal Investigator 28 Feb. 1980 5 p Sponsored by NASA HCMM
(E80-10142; NASA-CR-163160) Avail: NTIS
HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Day-visible and day-IR imagery of northwest Queensland show that large scale geological features like the Mitakoodi anticlinorium, which involves rocks of contrasting lithological type, can be delineated. North of Cloncurry, the contrasting lithological units of the Knapdale quartzite and bedded argillaceous limestones within the Proterozoic Corella sequence are clearly delineated in the area of the Dugald River Lode. Major structural features in the Mount Isa area are revealed on the day-visible cover which provides similar but less detailed information than the LANDSAT imagery. The day-IR cover provides less additional information for areas of outcropping bedrock than had been expected. Initial studies of the day-IR and night-IR cover for parts of South Australia suggest that they contain additional information on geology compared with day-visible cover.

**N80-26730*#** Bureau de Recherches Geologiques et Minieres, Orleans (France).

**SPATIAL THERMAL RADIOMETRY CONTRIBUTION TO THE MASSIF ARMORICAIN AND THE MASSIF CENTRAL (FRANCE) LITHO-STRUCTURAL STUDY Progress Report, Aug. 1979 - Feb. 1980**

Jean-Yves Scanvic, Principal Investigator Mar. 1980 25 p refs Sponsored by NASA and CNES HCMM
(E80-10143; NASA-CR-163161) Avail: NTIS
HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Although the limited number of images received did not permit construction of a thermal inertia map, important geological details were obtained in the areas of lithology and tectonics. Interpretation of day, night, and seasonal imagery resulted in differentiating broad calcareous and dolomitic units in the Causse Plateau. In the Massif amoricain, some granite massifs were delineated which were not observed by LANDSAT. Neotectonic faults were also revealed.

**N80-26734*#** Geological Survey, Denver, Colo.

**GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Dec. 1979 - Feb. 1980**

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Feb. 1980 3 p Sponsored by NASA HCMM
(E80-10147; NASA-CR-163165) Avail: NTIS
HC A02/MF A01 CSCL 08G

**N80-26759#** South Carolina Land Resources Conservation Commission, Columbia.

**APPLICATION OF SATELLITE DATA TO SURFACE MINE MONITORING IN SELECTED COUNTIES OF SOUTH CAROLINA Final Report, Sep. 1977 - Sep. 1978**

James N. Bayne and Hewson Lawrence Mar. 1979 141 p refs
(Grant DI-BM-G0-177166)
(PB80-144629; BM-OFR-11-80) Avail: NTIS
HC A07/MF A01 CSCL 08I

The LANDSAT data from computer compatible tapes were used to explore the capability of LANDSAT digital imagery to monitor mining and reclamation activity in several South Carolina mining operations. Differentiation between active-spoil-partially and completely reclaimed areas was successfully demonstrated including small mining operations of less than 30 acres. GRA

**N80-27778*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**MAGSAT SCIENTIFIC INVESTIGATIONS**

Robert A. Langel May 1980 42 p refs Submitted for publication
(NASA-TM-80698) Avail: NTIS HC A03/MF A01 CSCL 08G

The Magsat spacecraft is providing the first global, vector magnetic survey. Investigations using the Magsat data are being carried out by scientists at NASA's Goddard Space Flight Center, at the U.S. Geological Survey of the Department of the Interior and by 32 selected investigators. Nineteen of the investigators are from the United States and 13 are from various foreign nations. The investigations described fall into four categories: (1) geomagnetic field modeling; (2) crustal magnetic anomaly studies; (3) investigations of the inner Earth: the core, mantle and core-mantle interface; and (4) studies of external current systems. Author

**N80-27785#** Bendix Field Engineering Corp., Grand Junction, Colo.

**DEVELOPMENT OF DATA ENHANCEMENT AND DISPLAY TECHNIQUES FOR STREAM-SEDIMENT DATA COLLECTED IN THE NATIONAL URANIUM RESOURCE EVALUATION PROGRAM OF THE UNITED STATES DEPARTMENT OF ENERGY**

G. S. Koch, Jr. (Georgia Univ., Athens), R. J. Howarth (Imperial Coll., London), R. H. Carpenter (Georgia Univ., Athens), and J.

H. Schvenemeyer (Delaware Univ.) Athens, Ga. Georgia Univ.
Aug. 1979 236 p refs
(Contract EY-76-C-13-1664)
(GJBX-28(80)) Avail: NTIS HC A11/MF A01

Statistical, mapping, and geological techniques were combined in order to evaluate and appropriately display geochemical data for the identification of uranium associated halos utilizing the NURE hydrogeochemical and stream sediment reconnaissance data base. A set of computer-based procedures implemented in a time-sharing interactive mode on a Control Data Corporation Cyber 70 and 174 computer was developed. Techniques of data analysis are developed. Results of the data analysis for the Southeastern area, Seguin quadrangle, and Pueblo quadrangle are presented. Conclusions are drawn and recommendations are stated. DOE

## 05

# OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

**A80-33348** **The significance of satellite remote sensing for shipping (Die Bedeutung der Satelliten-Fernerkundung für die Schiffahrt).** W. Alpers (Hamburg, Universität; Max-Planck-Institut für Meteorologie, Hamburg, West Germany). *(Hermann-Oberth-Gesellschaft, Symposium über Satelliten im Dienst des internationalen Verkehrs, Hamburg, West Germany, June 9, 1979.) Astronautik*, vol. 16, no. 4, 1979, p. 104-107. In German.

The paper demonstrates that satellite remote sensing makes it possible to obtain information on meteorological and oceanographic conditions of wide areas of the ocean in a short time. Attention is given to the three areas of importance to shipping, seaway, wind on the sea surface, and icebergs, noting that optimum routing of shipping allows more economical and efficient operation. Also discussed are the satellites presently in use as well as those specifically for oceanographic purposes - GEOS 3 and Seasat 1. Finally, future satellite services for shipping are surveyed. M.E.P.

**A80-35691 #** **Use of satellite radiation information for obtaining oceanic surface temperature charts (Ispol'zovanie sputnikovoi radiatsionnoi informatsii dlia postroeniia kart temperatury poverkhnosti okeana).** V. V. Vinogradov (Gosudarstvennyi Okeanograficheskii Institut, Leningrad, USSR). *Okeanologiia*, vol. 20, Mar.-Apr. 1980, p. 335-344. 13 refs. In Russian.

Some aspects are examined of the reception and computer-aided processing of IR radiation data from operational satellites with a view to the utilization of the data for charting oceanic surface temperatures. Surface temperature measurements performed during the same time periods on board ships, satellites, and aircraft in the same area of the Atlantic Ocean are compared. V.P.

**A80-36289** **On the variability of surface temperature fronts in the western Pacific, as detected by satellite.** G. I. Roden (Washington, University, Seattle, Wash.). *Journal of Geophysical Research*, vol. 85, May 20, 1980, p. 2704-2710. 19 refs. Contract No. N00014-75-C-502. NR Project 083-012.

The paper investigates the variability of sea surface temperature fronts in the western North Pacific on the basis of satellite and shipboard data. Attention is given to fronts recognized by the satellite on a 100 km by 100 km grid over a period of 1 week, which include the subarctic front, the subtropical fronts, and one to two fronts associated with Kuroshio intrusion. It is shown that the findings by satellite are in broad agreement with those derived from shipboard observations employing a similar sampling scheme. Further, in order to study the relationship between satellite-derived temperature fronts and atmospheric flow patterns, the subtropical front is related to the configuration of the wind stress field. It is found that the oceanic front occurred near a persistent atmospheric front in a region where the vorticity and deformation of the wind stress change sign. M.E.F.

**A80-37575 *** **Spaceborne imaging radar - Monitoring of ocean waves.** R. C. Beal (Johns Hopkins University, Applied Physics Laboratory, Laurel, Md.). *Science*, vol. 208, June 20, 1980, p. 1373-1375. 8 refs. NASA-supported research; Contract No. NOAA-MO-A01-78-00-4330.

A well-organized, very low energy ocean swell system off the East Coast of the United States was tracked with the Seasat synthetic aperture radar from deep water, across the continental shelf, and into shallow water. The results indicate that spaceborne imaging radar may be used to accurately measure ocean wavelength and direction, even in coastal areas and in the presence of a mixed ocean. (Author)

**A80-37597** **Satellite sensing of ocean surface dynamics.** J. R. Apel (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.). In: Annual review of earth and planetary sciences. Volume 8. Palo Alto, Calif., Annual Reviews, Inc., 1980, p. 303-342. 56 refs.

The article is a representative review of selected results on the dynamics of the sea surface as obtained from satellite remote measurements with literature published through mid-1979 examined. Examples of methods for the determination of quantitative values for certain parameters of ocean surface dynamics theory are presented. Dynamics on planetary scale, mesoscale, and small scale are treated. These scales correspond roughly to physical events in the ocean: large-scale circulation and its variability; mesoscale eddy and upwelling motions; and small-scale fronts, internal waves, and surface gravity and capillary waves. Some preliminary results from Seasat are discussed. B.J.

**A80-37733 *** **GEOS-3 altimetry - Temporal variations in models of the Sargasso Sea.** R. S. Mather, R. Coleman, and B. Hirsch. In: The use of artificial satellites for geodesy and geodynamics. Volume 2 - Proceedings of the Second International Symposium, Athens, Greece, May 29-June 2, 1978. Athens, National Technical University of Athens, 1979, p. 500-530. 7 refs. Research supported by the Australian Research Grants Committee; Grant No. NsG-5225.

The Sargasso Sea test area lies to the east of the United States. Of the three possible modes, only the method of regional solutions and the method of overlapping passes are capable of using GEOS-3 altimetry data for oceanographic studies at the minimal plus or minus 50 cm resolution required for mapping of ocean eddies. In the present paper, the results obtained by these two methods are summarized, and the problems to be overcome in the recovery of quasi-stationary sea surface topography maintaining the steady-state component of the Gulf Stream are discussed. V.P.

**A80-37766** **The physical oceanography of two rings observed by the Cyclonic Ring Experiment. I - Physical structures.** A. C. Vastano, J. E. Schmitz, and D. E. Hagan (Texas A & M University, College Station, Tex.). *Journal of Physical Oceanography*, vol. 10, Apr. 1980, p. 493-513. 26 refs. NSF Grant No. OCE-76-82017; Contract No. N00014-75-C-0537.

Eight cruises over a 10-month period in the North Atlantic have provided the Cyclonic Ring Experiment with observations of two rings. Life histories, structure and structural changes have been studied with emphasis on the effects of Stream interaction and spindown processes. Ring AL was generated in September 1976 with a central water mass composed of Slope and anticyclonic ring waters. Ring BOB separated from the Stream in March 1977 with a Shelf and Slope Water core. Both rings had a 7-month lifetime, interacted with the Gulf Stream and were regenerated. The Stream interaction altered the core structures, and in the case of BOB, cruise observations show significant changes in ring size and shape. BOB's spatial extent decreased with interaction and increased during spindown while eccentricity of the ring behaved in an opposite manner. (Author)

**A80-37768** **Scales of thermal variability in the tropical Pacific.** T. P. Barnett and W. C. Patzert (California, University, La Jolla, Calif.). *Journal of Physical Oceanography*, vol. 10, Apr. 1980, p. 529-540. 31 refs. NSF Grant No. OCE-76-80183.

The paper discusses the long-range P-3 aircraft which were used to drop airborne expendable bathythermographs (AXBT's) along two long meridional sections across the central equatorial Pacific. The sections were occupied approximately every week for two to three months, depending on the longitude. Analysis of the space time scales of the temperature section time series suggested conclusions which included: (1) large-scale coherent meridional variability exists in the region within plus or minus 10 deg of the equator; (2) at 150 deg W, the large scale variability generally extends coherently across the equator, the boundaries between major equatorial currents, and the intertropical convergence zone; (3) some dissimilarity exists between the two meridional sections in the latitude range of the Line Islands, suggesting that the island may play a predominant role in 'contaminating' temperature observations in the vicinity; and (4) a large scale east-west coherence between the two sections was observed near the bottom of the mixed layer. A.T.

**A80-38601** **A method of digital image processing for the enhancement of oceanographic features in Landsat data (Ein Verfahren der digitalen Bildverarbeitung zur Hervorhebung ozeanographischer Phänomene aus Landsat-Daten).** O. G. Malan (South African Council for Scientific and Industrial Research, National Physical Research Laboratory, Pretoria, Republic of South Africa). *Bildmessung und Luftbildwesen*, vol. 47, Sept. 1, 1979, p. 161-165. 5 refs. In German.

The paper demonstrates that by calculation of the mean of the radiance values of groups of several lines and samples in Landsat data a decreased spatial resolution can be simulated. It is shown that provided the increased precision of the resulting radiance values is retained, a dramatic enhancement of low contrast features, of particular interest over bodies of water can be achieved. M.E.P.

**A80-38789** # **Earth-oriented research at ESA - Preparation of a new programme.** R. Tessier (ESA, Paris, France). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 49-56.

The earth-oriented research program of the ESA is discussed in terms of missions and boundary conditions. The objectives and areas of scientific interest in climatology/atmospheric physics, oceanography, ice studies and solid earth physics are considered in detail. Satellite instrumentation and preliminary satellite design are also surveyed. J.P.B.

**A80-38807** # **Determination of chlorophyll concentration in the sea from Nimbus-7 Coastal Zone Color Scanner /CZCS/ data.** B. Sturm (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 271-283. 14 refs.

Techniques used to extract quantitative information on chlorophyll distribution in the upper layers of the sea from Nimbus-7 Coastal Zone Color Scanner (CZCS) data are presented and applied to images of the coastal Tyrrhenian Sea. The relation between the concentration of chlorophyll-like pigments in the upper layers of the sea and the ratio of spectral upwelling radiance at 443 and 550 nm is presented, and techniques for the evaluation of the water-leaving spectral radiance from the measured radiance, glitter radiance, atmospheric transmittance and scattered path radiance for each pixel of CZCS imagery are outlined. Results of the application of a computer program based on the possible chlorophyll retrieval algorithms to CZCS CCTs of the Ligurian and Tyrrhenian coast of Italy are illustrated, and are shown to correspond to measured chlorophyll-a values. The utility of CZCS imagery in chlorophyll determinations in coastal waters with low suspended inorganic matter is concluded, although the various chlorophyll algorithms presently available tend to disagree at high chlorophyll concentrations. A.L.W.

**A80-39026** **Satellite evidence of enhanced upwelling along the European continental slope.** R. R. Dickson, P. A. Gurbutt (Ministry of Agriculture, Fisheries and Food, Fisheries Laboratory, Lowestoft, Suff., England), and V. N. Pillai. *Journal of Physical Oceanography*, vol. 10, May 1980, p. 813-819. 5 refs.

TIROS-N AVHRR imagery is used to describe a persistent but localized band of upwelling which follows the contours of the European continental slope from the Porcupine Seabight (southwest of Ireland) to the Bay of Biscay. Its persistent occurrence, its close association with the upper part of the slope, and the northward broadening of the upwelling region are shown to be consistent with recently published theory (Killworth, 1978) concerning the enhancement of upwelling by interaction between slope topography and Kelvin (or other) waves propagating along the slope. Some limited evidence of enhanced biological productivity is also described. (Author)

**A80-39158** **Quantitative remote sensing using aerial photography, assisted by the LETIC image processing system (Télédetection quantitative par photographie aérienne à l'aide du système LETIC de traitement d'image).** A. Llebaria (CNRS, Laboratoire d'Astronomie Spatiale, Marseille, France) and C. Valerio (CETE, Aix-en-Provence, France). In: Pattern recognition and artificial intelligence; Congress, 2nd, Toulouse, France, September 12-14, 1979, Proceedings. Volume 2. Rocquencourt, Yvelines, France, Institut de Recherche d'Informatique et d'Automatique, 1979, p. 84-90. 10 refs. In French.

An operational system of quantitative remote sensing, designed for the study of coastal marine pollution, is presented. The sensing method uses aerial photography and rhodamine B as a tracer in the water. Parasitic effects are suppressed by a selective extraction method based on the use of the LETIC interactive image processing system. B.J.

**A80-39222** **Measurements of atmospheric transmittance in a maritime environment.** W. H. Wilson (California, University, La Jolla, Calif.). In: Atmospheric effects on radiative transfer; Proceedings of the Seminar, San Diego, Calif., August 29, 30, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 153-159. 12 refs. Grant No. NOAA-04-6-158-44033; Contract No. N00014-78-C-0566.

For quantitative analysis of ocean color from high altitude or orbital platforms, it is necessary to correct the apparent signal for losses and gains due to atmospheric scattering and absorption. However, comprehensive knowledge of the transmittance and path radiance of the atmosphere over the oceans necessary for these corrections is limited. In order to support studies of ocean color utilizing the Coastal Zone Color Scanner aboard Nimbus-7, measurements of atmospheric transmittance and path radiance have been made at a number of maritime stations. The measurements were made at ten wavelengths between 400 and 750 nanometers and have provided new insight into atmospheric scattering and absorption over the ocean. A description of the solar transmissometer used in the program is provided along with some of the measurements. Comparisons of the measurements with predictions from the atmospheric transmittance program LOWTRAN have been made and are discussed. The significance of the measurements to the remote sensing of the ocean color is also reviewed. (Author)

**A80-39740** * **Remote sensing of coastal fronts and their effects on oil dispersion.** V. Klemas (Delaware, University, Newark, Del.). *International Journal of Remote Sensing*, vol. 1, Jan.-Mar. 1980, p. 11-28. 15 refs. NSF Grant No. GI-41896; Contracts No. NAS5-21937; No. NAS5-20983.

The use of remote sensing techniques to determine the properties of coastal and estuarine fronts, which represent regions of discontinuities and high gradients in ocean physical parameters such as velocity and density, and to assess the influence of such fronts on oil pollutants is discussed. Results of an aircraft and boat verification study of an oil drift and spread model in Delaware Bay are indicated which illustrate the tendency of oil slicks to be attracted to frontal regions, where a denser fluid underlies a lighter fluid giving rise to an inclined interface with convergence zones. Landsat imagery of the bay acquired in order to incorporate frontal information into the interactive computer model is then presented which allows the locations of coastal fronts to be charted throughout a tidal cycle. It is noted that satellite observations of flood-associated fronts on the New Jersey side of the bay and ebb-associated fronts on the Delaware side agree with boat measurements and model predictions, and that the remote tracking of fronts by aircraft and satellites will aid in oil slick clean-up operations. A.L.W.

**A80-39753** # **New problems of the theory of ocean tides (Novye problemy teorii okeanskikh prilivov).** B. A. Kagan. *Itogi Nauki i Tekhniki, Seriia Okeanologiia,* vol. 5, 1979, p. 78-116. 66 refs. In Russian.

The possibility of using satellite observations to study ocean tides is examined, and satellite data on the dissipation of tidal energy in the ocean are analyzed. The global interaction of ocean tides and tides in the earth crust is discussed with reference to the problem of the tidal energy budget. The unsolved problem of the parameterization of shelf effects is also considered; the importance of this problem in the numerical modeling of tides in the world ocean is indicated. B.J.

**A80-39856** # **Current problems of satellite oceanography (Sovremennye problemy sputnikovoi okeanologii).** B. A. Nelepo (Akademiia Nauk Ukrainskoi SSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 55-63. 17 refs. In Russian.

The possibility that satellite observations can solve some of the basic theoretical and applied problems of oceanography is discussed. Three broad areas of oceanography are considered: ocean surface temperature, (2) the radiative balance of the ocean-atmosphere system, and (3) the investigation of ocean depth. The possibilities and future perspectives of satellite oceanography are reviewed. B.J.

**A80-39857** # **The hopes and reality of space oceanography (Nadezhdy i real'nosti kosmicheskoi okeanologii).** K. N. Fedorov (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 64-78. 50 refs. In Russian.

Current progress in the application of remote sensing to the study of processes in the surface layers of the ocean is reviewed; emphasis is on whether advanced remote sensing methods are adequate to solve the fundamental problems of oceanography. Particular attention is given to the use of satellite observations for the study of sea level, sea surface state, salinity, eddies, and internal waves. B.J.

**A80-40019** **Comments 'On the remote detection of swell by satellite radar altimeter'.** R. E. Coulter (Mississippi State University, Bay Saint Louis, Miss.). *Monthly Weather Review,* vol. 108, June 1980, p. 829, 830; Reply p. 830.

**A80-40025** # **Regular monthly mean temperatures of earth's oceans from satellites.** A. E. Strong and J. A. Pritchard (NOAA, National Environmental Satellite Service, Washington, D.C.). *American Meteorological Society, Bulletin,* vol. 61, June 1980, p. 553-559. 11 refs.

Comparisons of satellite-derived monthly mean sea surface temperature anomalies with National Marine Fisheries Service (NMFS) ship-derived monthly mean sea surface temperature anomalies over the North Pacific Ocean reveal some encouraging results. Although still far from perfect, correlation coefficients for linear fits of 0.34, 0.49, 0.50, and 0.55 are observed for the winter months of November 1977, December 1977, January 1978, and February 1978, respectively. The standard error of estimate remained close to + or - 0.6 C and the satellite-ship temperature difference between the overall monthly mean anomaly vacillated between +0.31 C (December 1977) and -0.30 C (February 1978). Several other comparisons are presented. (Author)

**A80-41313** **Four channel synthetic aperture radar imagery results of freshwater ice and sea ice in Lake Melville.** S. K. Parashar, C. Roche, and R. D. Worsfold (Newfoundland Memorial University, St. John's, Canada). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 229-240. 14 refs.

**A80-41315** **Sea surface temperature and related measurements of the South Caribbean Sea utilizing GOES, NOAA and GOSSTCOMP data for locating structures.** S. E. Roy (Resource Surveys International, Inc., Closter, N.J.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 261-288. 20 refs.

Data from GOES and NOAA of the South Caribbean Sea was studied from both analog facsimile and digital tapes. The results from different data processing programs were compared with GOSSTCOMP (global operational sea-surface temperature computation) temperature changes and with single pass composite alphanumeric maps, from digital analysis of GOES data, besides photographic facsimile images. The comparisons were made for determining utility in defining eddies, upwellings, and structures and their movement, formation and dissipation, over the area under study. The results demonstrate that with difficulty, it is feasible to discern temperature gradients and SST (sea surface temperature) structures, in near real time, with fair accuracy, approaching NOAA data analysis. (Author)

**A80-42063** * **Seasat performance evaluation - The first two steps.** D. B. Lame, G. H. Born, J. A. Dunne, A. J. Spear, and C. A. Yamarone (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 72, 73. 9 refs. Contract No. NAS7-100.

Seasat, the satellite dedicated to the study of the oceans using microwave sensors, collected a data set containing information on sea surface winds, sea surface temperatures, wave heights, wave directions, internal waves, currents, tides, the marine geoid, and atmospheric water content. The first two steps of the performance evaluation of the satellite have been completed: (1) the engineering assessment and (2) the sensor evaluation. The results are encouraging for the performance of the instruments and the first level of data processing algorithms. S.D.

**N80-22662***# Applied Science Associates, Inc., Apex, N. C.
**RADAR ALTIMETER MEAN RETURN WAVE FORMS FROM NEAR-NORMAL-INCIDENCE OCEAN SURFACE SCATTERING Final Report**
George S. Hayne Wallops Island, Va. NASA. Wallops Flight Center Apr. 1980 27 p refs
(Contract NAS6-2810)
(NASA-CR-156864) Avail: NTIS HC A03/MF A01 CSCL 20N

For a nearly Gaussian transmitted pulse shape scattered from a nearly Gaussian distributed sea surface, a small argument series expansion of one term lead to a several term power series expression for the mean return waveform. Specific expressions are given for the first four terms. These results, which require less computer time than numerical convolution, are useful for data analysis from current or past radar altimeters and for design studies of future systems. Several representative results are presented for an idealized Seasat-1 radar altimeter. E.D.K.

**N80-23754**# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
**REMOTE SENSING OF AQUATIC PLANTS Final Report, Sep. 1976 - Sep. 1977**
Katherine S. Long Oct. 1979 103 p refs
(AD-A081737; WES-TR-A-79-2) Avail: NTIS HC A06/MF A01 CSCL 14/5

This report summarizes a 3 year effort in evaluating the various available remote sensing methods for identification and assessment of expanses of aquatic plants. Both materials and techniques are examined for cost effectiveness and capability to sense aquatic plants on both the local and regional scales. Computer simulation of photographic responses was employed. LANDSAT, high-altitude photography, side-looking airborne radar, and low-altitude photography were examined to determine the capabilities of each for identifying and assessing aquatic plants. Results of the study revealed LANDSAT to be the most cost effective for regional surveys, although its coarse resolution would be limiting in some cases. High-quality, high-altitude false-color infrared film showed great potential for species identification. Model studies borne out by field demonstrations showed black-and-white infrared photography to have a strong potential for discriminating infested from uninfested areas, with less associated cost than when false-color infrared is used. False-color infrared does show the greatest potential for discriminating among species. Ground-truth information concerning a specific area aids materially in the mapping. Examples of photographs, maps, and cost analyses of two demonstration projects conducted at Lake Marion, South Carolina, and Lake Seminole Florida, are included. GRA

**N80-23908*#** Department of Energy, Mines and Resources, Ottawa (Ontario). Gravity and Geodynamics Div.
**INVESTIGATION OF TIDAL DISPLACEMENTS OF THE EARTH'S SURFACE BY LASER RANGING TO GEOS-3**
D. R. Bower, J. Halpenny, M. K. Paul, and A. Lambert Apr. 1980 32 p refs
(NASA-CR-156863) Avail: NTIS HC A03/MF A01 CSCL 08F

An analysis of laser ranging data from three stations was carried out in an attempt to measure the geometric Earth tide. Two different approaches to the problem were investigated. The dynamic method computes pass to pass apparent movements in stations height relative to short arcs fitted to several passes of data from the same station by the program GEODYNE. The quasi-geometric method reduces the dependence on unmodelled satellite dynamics to a knowledge of only the radial position of the satellite by considering two station simultaneous ranging at the precise time that the satellite passes through the plane defined by two stations and the center of mass of the Earth. E.D.K.

**N80-23961#** Phoenix Corp., McLean, Va.
**VALIDATION OF OCEAN TIDE MODELS FROM SATELLITE ALTIMETRY Interim Progress Report, May - Oct. 1978**
R. D. Brown 15 Oct. 1979 36 p refs
(Contract N00014-79-C-0409)
(AD-A078294) Avail: NTIS HC A03/MF A01 CSCL 08/3

Tides in the deep ocean can be determined directly from satellite altimetry, completely independent of assumptions about earth tides, bottom topography and coastal geometry and thus free of the uncertainties which plague numerical tide models. Existing tide models differ by 1 meter or more in the value of sea surface height in the deep ocean at a given place and time. This uncertainty is a formidable obstacle to determination of a precise marine geoids from satellite altimetry. By harmonic analysis of the temporal changes in altimeter measurements at satellite subtrack crossover points, it is possible to solve for the amplitude and phase of harmonic tidal components. However, care must be exercised in the removal of satellite orbit errors, and in the selection of crossovers for sufficient observability of the phase angle of the harmonic tidal component. Preliminary tidal solutions in the Gulf of Alaska using the relatively sparse GEOS-3 altimeter data distribution show generally good agreement (20 cm in amplitude and 25 degrees in phase) with deep ocean bottom pressure gauge measurements and establish the feasibility of this technique. SEASAT altimeter data yields a much greater density of crossovers (400 plus per 1/2 deg by 1/2 deg area), making possible much better separation of individual harmonic components within the semi-diurnal and diurnal families. GRA

**N80-24941#** National Research Inst. for Oceanology, Stellenbosch (South Africa). Physical Oceanography Div.
**USE OF METEOSAT IN SOUTHERN OCEAN OCEANOLOGY AND SOUTHERN HEMISPHERE METEOROLOGY**
Jre Lutjeharms Jun. 1979 30 p refs Presented at the ESA Conf. on Meteosat Usage, Darmstadt, West Germany, Jun. 1979
(CSIR-SEA-7918; ISBN-0-7988-1557-4) Avail: NTIS HC A03/MF A01

The use of Meteosat data in the refinement of weather prediction, determination of wind vectors, investigations on thunderstorms, the tracking of pollution plumes as well as in studies on the flooding of river mouths, on the water flux in and out of large lakes, and on the behaviour of ocean currents and ocean upwelling phenomena is briefly discussed. The placement of a drifting buoy in the south Atlantic Ocean using hourly thermal infrared images is also described. Some of the advantages and shortcomings of the data for oceanologic research are pointed out. M.G.

**N80-25763*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OVERSEAS TRIP REPORT, CV 990 UNDERFLIGHT MISSION**
P. Gloersen, J. Crawford, and L. Hardis (OAO Corp., Beltsville, Md.) Mar. 1980 95 p refs
(NASA-TM-80662) Avail: NTIS HC A05/MF A01 CSCL 08L

The scanning microwave radiometer-7 simulator, the ocean temperature scanner, and an imaging scatterometer/altimeter operating at 14 GHz were carried onboard the NASA CV-990 over open oceans, sea ice, and continental ice sheets to gather surface truth information. Data flights were conducted over the Norwegian Sea to map the ocean polar front south and west of Bear Island and to transect several Nimbus-7 footprints in a rectangular pattern parallel to the northern shoreline of Norway. Additional flights were conducted to obtain correlative data on the cryosphere parameters and characteristics of the Greenland ice sheet, and study the frozen lakes near Barrow. The weather conditions and flight path way points for each of the nineteen flights are presented in tables and maps. A.R.H.

**N80-26023*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
**GEOS-3 RADAR ALTIMETER STUDY FOR THE SOUTH ATLANTIC BIGHT**
C. D. Leitao, N.E. Huang, C. L. Parsons, C. G. Parra (EG and G Washington Analytical Services Center), J. D. McMill (EG and G Washington Analytical Services Center), and G. S. Hayes (Applied Sci. Associates, Inc.) May 1980 144 p refs
(Contract DI-AA551-IA8-39)
(NASA-TM-73286) Avail: NTIS HC A07/MF A01 CSCL 08C

Three years of radar altimeter data from GEOS-3 for the South Atlantic Bight were processed. Mean monthly topographic maps were produced which estimate geostrophic flow in the region. Statistical distribution of the surface wind speed and significant wave height as a function of both space and time are presented. R.E.S.

**N80-26739*#** Instituto Geografico Nacional, Madrid (Spain).
**THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report**
Rodolfo Nunez delasCuevas, Principal Investigator, Fernando Lopez Sagredo, Joaquin Melia Miralles, Pedro Herranz Araujo, Jesus Paredes Perlado, D. Antonio Parrillo, D. J. Luis Placon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez 31 Dec. 1979 41 p refs Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10156; NASA-CR-163173; PR-2) Avail: NTIS HC A03/MF A01 CSCL 08B

**N80-26744*#** General Electric Co., Philadelphia, Pa.
**ASSESSMENT OF THE USE OF SPACE TECHNOLOGY IN THE MONITORING OF OIL SPILLS AND OCEAN POLLUTION: EXECUTIVE SUMMARY**
U. R. Alvarado, ed. Apr. 1980 68 p
(Contract NAS1-15657)
(NASA-CR-159243) Avail: NTIS HC A04/MF A01 CSCL 13B

The adequacy of current technology in terms of stage of maturity, of sensing, support systems, and information extraction was assessed relative to oil spills, waste pollution, and inputs to pollution trajectory models. Needs for advanced techniques are defined and the characteristics of a future satellite system are determined based on the requirements of U.S. agencies involved in pollution monitoring. A.R.H.

**N80-26745*#** General Electric Co., Philadelphia, Pa. Space Div.
**ASSESSMENT OF THE USE OF SPACE TECHNOLOGY IN THE MONITORING OF OIL SPILLS AND OCEAN POLLUTION: TECHNICAL VOLUME. EXECUTIVE SUMMARY**
U. R. Alvarado, ed., G. Chafaris, J. Chestek, J. Contrad, G. Frippel, R. Gulatsi, A. Heath, H. Hodara (Tetra Tech., Inc., Pasadena, Calif.), H. Kritikos (Pennsylvania Univ., Philadelphia), and K. Tamiyasu Apr. 1980 464 p refs
(Contract NAS1-15657)
(NASA-CR-159242; Doc-80SDS4203) Avail: NTIS HC A20/MF A01 CSCL 13B

The potential of space systems and technology for detecting and monitoring ocean oil spills and waste pollution was assessed as well as the impact of this application on communication and data handling systems. Agencies charged with responsibilities in this area were identified and their measurement requirements were ascertained in order to determine the spatial resolution needed to characterize operational and accidental discharges. Microwave and optical sensors and sensing techniques were evaluated as candidate system elements. Capabilities are described for the following: synthetic aperture radar, microwave scatterometer, passive microwave radiometer, microwave altimeter, electro-optical sensors currently used in airborne detection, existing space-based optical sensors, the thematic mapper, and the pointable optical linear array. A.R.H.

**N80-27736#** Kiel Univ. (West Germany). Inst. for Marine Research.
**THE EARTH'S HYDROSPHERE AND CRYOSPHERE Final Report**
W. Krauss *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 28-34

Avail: NTIS HC A10/MF A01

The role of upper ocean circulation as a critical element in models of climatic change on the scale of weeks or decades is discussed. Emphasis is placed on the sea surface temperature as the most important quantity for climate studies, because it controls the transfer of thermal energy from the ocean to the atmosphere. It is proposed that key ocean parameters be monitored from space. Instrumentation considered includes satellite-borne altimeters, scatterometers, scanning multichannel microwave radiometers, and infrared radiometers. Both Oceanographic and ice measurements are covered. Author (ESA)

**N80-27747#** Institute of Oceanographic Sciences, Wormley (England).
**SPACE AND TIME SCALES OF OCEAN CIRCULATION**

W. J. Gould *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 105-110 refs
Avail: NTIS HC A10/MF A01

The developments which have led to the present view of mesoscale features in the deep ocean are described. Results illustrating the space and time scales of features studied during the mid-ocean dynamics experiment are presented. Suggestions are made for fields in which satellite data are likely to enhance knowledge of ocean circulation. Author (ESA)

**N80-27748#** Institute of Oceanographic Sciences, Wormley (England).
**SATELLITE ALTIMETRY MEASUREMENTS OF THE SEA SURFACE**
T. D. Allan *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 113-120 refs
Avail: NTIS HC A10/MF A01

Some of the preliminary observations made with the SEASAT precise radar altimeter are reviewed. Examples are taken from recently published work on data from over the western North Atlantic where the dynamic height profiles, calculated from the available geoid model, exhibit not only a strong one to two M signal over the width of the Gulf Stream, but also smaller amplitude anomalies which are associated with mobile cold rings of some 200 km diameter. Examples of repeat profiles recorded during the period of the SEASAT frozen orbit are shown over an area in the eastern Atlantic. They exhibit a remarkable repeatability of small features in the geoid and analysis to detect possible eddies and currents is discussed. A comparison of significant wave heights measured by the altimeter and by a surface buoy is shown to agree to about 20 cm. Author (ESA)

**N80-27760#** Cambridge Univ. (England). Dept. of Applied Mathematical and Theoretical Physics.
**OCEAN CIRCULATION**
D. L. T. Anderson *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. (CHARM) from Space Feb. 1980 p 209-215 refs
Avail: NTIS HC A10/MF A01

Several different phenomena are discussed which have quite a large signature in sea surface elevation. Satellite altimetry is shown to have the potential for monitoring these phenomena and increasing knowledge of them. To date, only eddies have been mapped successfully by altimeters. Nonetheless, attempts should be made to try to measure other variables both at and below the ocean surface. Author (ESA)

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# 06
# HYDROLOGY AND WATER MANAGEMENT

**Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.**

**A80-35186** **Digital correlation of remote sensing data of mud flats (Digitale Korrelation von Fernerkundungsbildern aus Wattgebieten).** B. Wrobel and M. Ehlers (Hannover, Universität, Hanover, West Germany). *Bildmessung und Luftbildwesen,* vol. 48, May 1, 1980, p. 67-79. 9 refs. In German. Deutsche Forschungsgemeinschaft Contract No. SFB-149.

The paper reports on the development of a concept for rectification on a mutual reference image in order to permit correlation of remote sensing photographs of mud flats. It is reported that different objective functions show some deviations in the results due to the unstructured topography of the mud flats. Attention is given to quality and accuracy of two chosen objective functions which are presented by examples for autocorrelation as well as unitemporal and multitemporal correlation. Finally, a prehandling of the data by geometric or densitometric treatment is shown to be necessary for increasing the available information from the image signals. M.E.P.

**A80-35295** **Inland /non-tidal/ wetland mapping.** W. R. Stewart, V. Carter, and P. D. Brooks (U.S. Geological Survey, Reston, Va.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, May 1980, p. 617-628. 6 refs.

Three experimental wetland maps prepared for the Auburndale, Fla. quadrangle are described. Wetland classes and boundaries were interpreted from quadcentered high-altitude color-infrared and super-wide black-and-white panchromatic photographs onto a black-and-white orthophoto base map from a color infrared photograph. Three wetland classification systems were tested for possible production use by U.S. Geological Survey compilers; the finished maps were compared with standard survey 1 to 24,000-scale maps. The Cowardin system was found to be best because the definitions were easier to apply in the photoidentification process, and the density and variety of wetland classes were greater than when other systems were used for classification. A.T.

**A80-35296** * **Enumeration of prairie wetlands with Landsat and aircraft data.** D. S. Gilmer (U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Jamestown, N. Dak.), E. A. Work, Jr., J. E. Colwell, and D. L. Rebel (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, May 1980, p. 631-634. 16 refs. Research supported by the U.S. Fish and Wildlife Service and NASA.

A method is described for estimating wetland abundance in the 700,000 sq km prairie pothole region of North America. A double sampling procedure is described, incorporating the use of high resolution aircraft imagery, capable of delineating ponds as small as 5 m across, as a means of adjusting the count of surface water features derived from the low-resolution Landsat census over a 38,876 sq km area in east-central North Dakota. The regression expansion formula used to estimate the actual number of total wetlands is also presented. J.P.B.

**A80-36244** * **Permittivity and attenuation of wet snow between 4 and 12 GHz.** W. I. Linlor (NASA, Ames Research Center, Moffett Field, Calif.). *Journal of Applied Physics,* vol. 51, May 1980, p. 2811-2816.

The permittivity and attenuation of prepared samples of wet snow are measured and curves presented showing the dependence of these quantities of snow wetness and frequency. Equations are given that express the experimentally determined relation between attenuation per unit length and volume-percent wetness at any frequency between 4 and 12 GHz. Additional equations are given for the calculation of permittivity from the snow density, attenuation per unit length, and frequency. Water retention characteristics of snow are described. Some applications of the techniques, such as runoff forecasting from mountain snowpacks, are proposed. (Author)

**A80-38790** # **The integrated use of two aerospace platforms for research on discharges of water into the sea - The case of the Tiber (L'uso integrato di due piattaforme aerospaziali per ricerche su scarichi d'acqua in mare - Il caso del Tevere).** G. M. Lechi and A. Todisco (Società Italiana per il Telerilevamento, Milan, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 57-63. In Italian.

A remote sensing methodologic approach for the analysis of physical processes related to river discharges into the sea is described. The test area is the twin outfall of the Tiber River. Several surveys were performed employing Landsat and thermal aerial images simultaneously. The thermal aerial data, taken in the 9/11 micron band, were calibrated by means of simultaneous sea truth collection (temperature, salinity). An interpretation of some hydrodynamic phenomena is also presented for the days of the surveys. (Author)

**A80-39852** # **Glaciological research and experiments aboard the Salyut-6 orbital station (Gliatsiologicheskie issledovaniia i eksperimenty na orbital'noi stantsii 'Saliut-6').** S. V. Desinov, G. A. Nosenko, V. M. Kotliakov (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda; Akademiia Nauk SSSR, Institut Geografii, Moscow, USSR), G. M. Grechko, and A. S. Ivanchenkov. *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 25-34. In Russian.

The first results of glaciological research performed aboard Salyut 6 are reviewed. Visual and photographic observations of snow cover and glaciers in the Pamir area are considered; the area was examined with regard to amount of snow, large morphological features of the ice surface, and indications of surging glaciers. Space observations made it possible to forecast glacier surges and to reveal traces of past advances; they also showed runoff from glacier-dammed lakes. Further, the studies of glacier dynamics on the northern and southern Patagonian plateaus showed abrupt changes in the marginal areas of O'Higgins, Moreno, and Braggen glaciers. This excessive activity is induced by the large glaciation energy of Patagonia and the adjacency of glacier tongues with water. B.J.

**A80-41306** **A remote sensing technique to monitor benthic algae.** F. J. Tanis (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 101-113. Research supported by the U.S. Environmental Protection Agency.

Low altitude aircraft multispectral scanner data has been demonstrated to be useful to monitor nearshore water quality problems. Multispectral data collected on Lake Ontario were processed to show distribution of attached algae. Ground truth data as unit area samples of bottom vegetation were collected at several locations marked in the imagery by surface floats. A depth invariant model based upon principal component analysis was used to process seven passive bands between 0.46 and 0.70 m. Single features were obtained from the analysis which can be related to algal standing crop. Computer generated color maps were produced to show spatial distribution and standing crop of the benthic communities. (Author)

**A80-41311** **Mapping coastal wetlands of Mississippi with remote sensing.** C. A. Gazzier, R. L. Frederking, and V. H. Minshew (Mississippi, University, University, Miss.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 187-198. Research supported by the Mississippi Governor's Office of Science and Technology.

Coastal wetlands of Mississippi have been delineated and mapped from high altitude aircraft and Landsat imagery. Photomapping techniques were used to discriminate and to map seven discrete classes of coastal wetlands from high altitude false color infrared photography. Four of the delineated wetland classes correspond spatially with previously defined wetland areas which were field mapped in detail on the basis of biologic assemblage and salinity characteristics. Landsat imagery was effective for regional delineation of coastal wetlands. Color additive video enhancement of the satellite imagery provided for differentiating major groups of wetland dependent vegetation. Results of the investigation indicate that coastal wetlands can be accurately and efficiently mapped from high altitude CIR photography. Synoptic coverage afforded by Landsat provides the means to monitor time dependent change in wetland environments and to identify site specific problem areas which require immediate attention. (Author)

**A80-41314 *** **Korean coastal weter depth/sediment and land cover mapping /1:25,000/ by computer analysis of Landsat imagery.** K. Y. Park and L. D. Miller (NASA, Goddard Space Flight Center, Greenbelt, Md.; Colorado State University, Fort Collins, Colo.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 241-260.

Computer analysis was applied to single data Landsat MSS imagery of a coastal area near Seoul, Korea equivalent to a 1:50,000 topographic map, and featuring large dynamic sediment transport processes. Supervised image processing yielded a test classification map containing five water depth/sediment classes, two shoreline/tidal classes and five coastal land cover classes at a scale of 1:25,000 and with a training set accuracy of 76%; the training sets were selected by direct examination of the digitally displayed imagery. The unsupervised ISOCLAS (Senkus, 1976) clustering analysis was performed to assess the relative value of this approach to image classification in areas of sparse or nonexistent ground control. Results indicate that it is feasible to produce quantitative maps for detailed study of dynamic coastal processes given a Landsat image data base at sufficiently frequent time intervals. J.P.B.

**A80-41316** **Monitoring of water quality and trophic states in shallow coastal lakes and estuaries - A use of Landsat imagery.** C. W. Welby, A. M. Witherspoon, and R. E. Holman (North Carolina State University, Raleigh, N.C.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 289-312. 8 refs.

**A80-41673** **Kings Bay - Prelude to Georgia coastal zone aerial photography - 1979.** D. E. Thompson (Remote Sensing Analysts, Tucker, Ga.), R. J. Reimold, and M. J. Hardisky (Georgia Department of Natural Resources, Brunswick, Ga.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 199-214. 13 refs.

The 1978 and 1979 color infrared aerial photography project at the U.S. Navy Submarine Support Base, Kings Bay, Georgia refined marker deployment techniques precedent to the comprehensive 1979 color aerial photography program in Georgia's coastal zone. As part of the Georgia coastal zone management program, complete stereoscopic coverage in 23 cm x 23 cm format at a scale of 1:24,000 was intended to be obtained in 1979 and was to include all the estuarine marshes of Georgia at low tidal stage. B.J.

**A80-41676 *** **Assessing the impact of pipeline construction on coniferous wetlands in central Michigan with aerial photography.** K. M. Kittleson and M. E. McDavitt (Michigan State University, East Lansing, Mich.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 263-275. 6 refs. Grant No. NGL-23-004-083.

The Remote Sensing Project at Michigan State University is using repetitive aerial photography to assess the impact of pipeline construction on coniferous wetlands in central Michigan. Preliminary results indicate that ponding, dieback, windthrow, and vegetation changes are readily detectable on medium-scale aerial photography. It is found that the major effect of the pipeline construction is the alteration of the water level, either by flooding or dessication. The most serious damage generally occurs when pipelines cross seepage and spiring wetland types; specific damage is related to the impoundment of the natural water flow, producing flooding on the upflow side of the pipeline and dessication of these wetlands below the pipeline rights-of-way. B.J.

**A80-41677** **Wetlands mapping in northern Manitoba - An application of enhanced Landsat data.** V. Singhroy (Nova Scotia Land Survey Institute, Lawrencetown, Canada) and B. Bruce (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 277-287. 12 refs.

This paper demonstrates a practical Landsat-based methodology for reconnaissance-level classification, inventory and mapping of wetland environments over large areas. The methodology is based on visual interpretation of optically enhanced Landsat imagery. The approach was developed for cost-effective, operational use by resource managers, within conventional mapping programs. The interpretation techniques demand close integration with first-hand field knowledge normally associated with experienced resource managers; but do not require direct access to any specialized image interpretation aids. A full-scene Landsat interpretation is presented to demonstrate the procedure. The interpretations have been verified by an extensive and rigorous field sampling program. (Author)

**N80-22682#** Electronics Research Lab., Adelaide (Australia).
**THE INFLUENCE OF WATER TURBIDITY ON THE PERFORMANCE OF A LASER AIRBORNE DEPTH SOUNDER**
D. M. Philips Apr. 1979 29 p refs
(AD-A074153; ERO-0072-TR) Avail: NTIS HC A03/MF A01 CSCL 08/10

During flight trials of a laser airborne depth sounder (WRELADS), measurements were made of the optical attenuation coefficient of coastal waters in both South Australia and Queensland. Measurements of the attenuation coefficient at wavelengths from 400 nm to 600 nm are reported for a range of different water types, and the suitability for depth sounding of the laser wavelength 532 nm is confirmed. Variations of the attenuation coefficient at 530 nm over two vertical sections of sea water are reported and factors influencing the turbidity are suggested. Return signals recorded by the depth sounder are compared with measured attenuation coefficients of the water. It is shown that the maximum measurable water depth varies from below 4 to above 10 attenuation lengths, depending on the turbidity of the water. GRA

**N80-23712** Utah Univ., Salt Lake City.
**CATEGORIZATION OF WATERSHED LAND COVER UNITS WITH LANDSAT DATA Ph.D. Thesis**

Thomas Delane Frank 1979 187 p
Avail: Univ. Microfilms Order No. 8010660

Unsupervised training procedures were used to statistically and spatially analyze spectral variation in LANDSAT-2 MSS data for a semiarid watershed in east-central Utah. Categorization of the signatures was accomplished with a factor analysis procedure. Interclass distances among all signatures were computed, and a standardization distance matrix entered into an oblique factor analysis. Factors derived from the reduction of interclass similarities among signatures were interpreted as core land cover categories. Each of the land cover categories is an integrated terrain unit, consisting of similar vegetation and surface geology. The optimum number of integrated terrain units is readily determined. Categorization of signatures with this methodology allows a researcher to evaluate the adequacy of the signatures generated in an unsupervised training approach to actually represent land cover variation. If the optimum number of land cover categories is not known prior to classification of LANDSAT data, the basic number as represented in the LANDSAT signatures, is identified by this method which contributes to the labelling and categorization of individual signatures to the core land cover categories. Dissert. Abstr.

**N80-23737*#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**AUTOMATIC INTERPRETATION OF LANDSAT DATA TO CHARACTERIZE THE DISPERSION OF SUSPENDED SEDIMENTS IN ARTIFICIAL RESERVOIRS [ANALISE AUTOMATICA DE DADOS LANDSAT NO ESTUDO DA DISPERSAO DE SEDIMENTOS EM SUSPENSAO EM RESERVATORIOUS ARTIFICIAIS]**
Nelson deJesusParada, Tania Maria Sausen, and Vitor Celso deCarvalho, Principal Investigators Sep. 1979 40 p refs In PORTUGUESE; ENGLISH summary Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10110; NASA-CR-162821; INPE-1572-RPE/071) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-25734*#** California Univ., Berkeley. Space Sciences Lab.
**REMOTE SENSING ANALYSIS OF WATER QUALITY AND THE ENTRAPMENT ZONE IN THE SAN FRANCISCO BAY AND DELTA Final Report, 15 Mar. 1978 - 14 Aug. 1979**
Robert N. Colwell, Allen W. Knight, Principal Investigators, and Siamak Khorram 14 Aug. 1979 40 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NsG-5256)
(E80-10152; NASA-CR-163169; SSL-Ser-20-Issue-42) Avail: NTIS HC A03/MF A01 CSCL 13B

The author has identified the following significant results. Data from an ocean color scanner flown on a U-2 aircraft at 65,000 ft and from LANDSAT MSS were enhanced to identify biologically active areas of San Francisco Bay, and to determine the salinity, turbidity, chlorophylls, and suspended solids. The best fit regression models for mapping water quality parameters were based on bands 3, 5, 7, and 10. Comparision of the results indicate that chlorophyll concentrations can best be estimated by the OCS or MSS data. Salinity can best be estimated by OCS data; turbidity can best be estimated by LANDSAT data. Neither OCS nor MSS data provide reliable basis for estimating suspended solids. Aerial photography of the highest quality taken with either conventional color or infrared-sensitive color films was unable to locate the biologically active areas.

**N80-25739*#** Bern Univ. (Switzerland). Dept. of Geography.
**TOPOCLIMATOLOGICAL AND SNOWHYDROLOGICAL SURVEY OF SWITZERLAND Progress Report**
Matthias Winiger, Principal Investigator Apr. 1980 6 p
Sponsored by NASA HCMM
(E80-10164; NASA-CR-163181; PR-2) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Low temperature zones depend on the topography and the terrain coverage type (besides the meteorological situation). The usual pattern of cold zones at the bottom of the valleys, warmer belts along the valley slopes, and cold mountain tops is modified by the terrain coverage type. Rural and forested areas normally have different surface temperatures, but along a vertical profile the temperature decrease (or increase) is often of the same order of magnitude. Because there is also a close correlation between the topography and terrain coverage (high percentage of forested areas at the valley slopes up to the timber line, much less along the valley floors), the surface temperature of the warm slope zone is increased compared to a valley profile with uniform coverage.

**N80-25742*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**OPERATIONAL APPLICATIONS OF SATELLITE SNOW-COVER OBSERVATIONS**
Albert Rango, ed. and Ralph Peterson, ed. (GE, Beltsville, Md.) May 1980 294 p refs Workshop held at Sparks, Nev., 16-17 Apr. 1979; sponsored in part by Nevada Univ. Original contains imagery. Original photography may be purchased form the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10167; NASA-CP-2116) Avail: NTIS HC A13/MF A01 CSCL 08L

The history of remote sensing of snow cover is reviewed and the following topics are covered: various techniques for interpreting LANDSAT and NOAA satellite data; the status of future systems for continuing snow hydrology applications; the use of snow cover observations in streamflow forecasts by Applications Systems Verification and Transfer participants and selected foreign investigators; and the benefits of using satellite snow cover data in runoff prediction.

**N80-25743*#** Environmental Research and Technology, Inc., Concord, Mass.
**THE EVOLUTION OF SATELLITE SNOW MAPPING WITH EMPHASIS ON THE USE OF LANDSAT IN THE SNOW ASUT STUDY AREAS**
James C. Barnes and Clinton J. Bowley, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 1-19 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25744*#** National Environmental Satellite Service, Washington, D. C.
**THE NOAA/NESS PROGRAM FOR OPERATIONAL SNOW-COVER MAPPING: PREPARING FOR THE 1980'S**
Stanley R. Schneider, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 21-39 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25745*#** National Environmental Satellite Service, Washington, D. C.
**NEW GOALS FOR SNOW MONITORING BY SATELLITE**
D. R. Wiesnet, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 41-51 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25746*#** Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.

### MAPPING NEW ZEALAND AND ANTARCTIC SNOWPACK FROM LANDSAT

I. L. Thomas, T. D. Prowse (Canterbury Univ.), and I. F. Owens, Principal Investigators (Canterbury Univ.) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 53-72 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25747*#** Zurich Univ. (Switzerland). Dept. of Geography.

### DIGITAL MAPPING OF MOUNTAIN SNOWCOVER UNDER EUROPEAN CONDITIONS

Harold Haefner, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 73-91 refs Original contains imagery. Orginal photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A method for monitoring the snow cover in high mountain terrain such as the Swiss Alps includes the rapid classification of multitemporal data for small watersheds with very high accuracy. In addition to LANDSAT channels 4,5,6 and 7 an artificial channel was created containing the average altitude information of each pixel and allowing a subdivision of the watershed in accordance to the requirements of the runoff model. Even in very small watersheds of about 40 sq km the results achieved from LANDSAT data are at least as accurate as the ones gained from measurements of orthophotographs.

**N80-25748*#** IBM Norway, Oslo.

### APPLICATION OF SATELLITE DATA FOR SNOW MAPPING IN NORWAY

H. A. Odegaard, T. Andersen (Norwegian Water Resources and Elec. Board, Oslo), and G. Ostrem, Principal Investigators (Norwegian Water Resources and Elec. Board, Oslo) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 93-106 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A close quantitative relationship was found between snow covered areas and subsequent runoff for different parts of the country despite climate differences. Digital LANDSAT data can be used for areas down to approximately 10 sq km to 20 sq km for accurate measurement of snow cover extent. On large watersheds (more than 500 sq km), digital NOAA/TIROS imagery can be used for snow mapping if the area/runoff relationship is determined by using observations from previous years.

**N80-25749*#** Geological Survey, Phoenix, Ariz.

### SATELLITE SNOWCOVER AND RUNOFF MONITORING IN CENTRAL ARIZONA

Herbert H. Schumann, Edib Kirdar (Salt River Project), and William L. Warskow, Principal Investigators (Salt River Project) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 107-126 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. Although the very high resolution experimental LANDSAT imagery permits rapid snow cover mapping at low cost, only one observation is available very 9 days. In contrast, low resolution operational imagery acquired by the ITOS and SMS/GOES satellites provide the daily synoptic observations necessary to monitor the rapid changes in snow covered areas in the entire Salt-Verde watershed. Geometric distortions in meteorological satellite imagery require specialized optical equipment or digital image processing for snow cover mapping.

**N80-25750*#** Bonneville Power Administration, Portland, Oreg.

### USE OF SATELLITE DATA IN RUNOFF FORECASTING IN THE HEAVILY FORESTED, CLOUD-COVERED PACIFIC NORTHWEST

John P. Dillard and Charles F. Orwig, Principal Investigators (Natl. Weather Serv., Portland, Oreg.) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 127-150 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. Satellite-derived snow cover data improves forecasts of stream flow but not at a statistically significant amount and should not be used exclusively because of persistent cloud cover. Based upon reconstruction runs, satellite data can be used to augment snow-flight data in the Upper Snake, Boise, Dworshak, and Hungry Horse basins. Satellite data does not compare well with aerial snow-flight data in the Libby basin.

**N80-25751*#** Soil Conservation Service, Denver, Colo.

### LANDSAT DERIVED SNOWCOVER AS AN INPUT VARIABLE FOR SNOWMELT RUNOFF FORECASTING IN SOUTH CENTRAL COLORADO

B. A. Shafer and C. F. Leaf, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 151-169 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25752*#** Colorado Div. of Water Resources, Denver.

### A GRAPHICAL METHOD OF STREAM RUNOFF PREDICTION FROM LANDSAT DERIVED SNOWCOVER DATA FOR WATERSHEDS IN THE UPPER RIO GRANDE BASIN OF COLORADO

George F. Moravec and Jeris A. Danielson, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 171-183 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25753*#** California State Dept. of Water Resources, Sacramento.

### APPLICATION OF SNOWCOVERED AREA TO RUNOFF FORECASTING IN SELECTED BASINS OF THE SIERRA NEVADA, CALIFORNIA

A. J. Brown and J. F. Hannaford, Principal Investigators (Sierra Hydrotech) *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 185-200 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. Direct overlay onto 1:1,000,000 prints takes about one third the time of 1:500,000 zone transfer scope analysis using transparencies, but the consistency of the transparencies reduce the time for data analysis. LANDSAT data received on transparencies is better and more easily interpreted than the near real-time data from Quick Look, or imagery from other sources such as NOAA. The greatest potential for water supply forecasting is probably in improving forecast accuracy and in expanding forecast services during the period of snowmelt. Problems of transient snow line and uncertainties in future weather are the main reasons that snow cover area appears to offer little in water supply forecast accuracy improvement during the peroid snowpack accumulation.

**N80-25754*#** Sierra Hydrotech, Placerville, Calif.
**APPLICATION OF SATELLITE IMAGERY TO HYDROLOGIC MODELING SNOWMELT RUNOFF IN THE SOUTHERN SIERRA NEVADA**
J. F. Hannaford and R. L. Hall, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 201-222 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25755*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DISCHARGE FORECASTS IN MOUNTAIN BASINS BASED ON SATELLITE SNOW COVER MAPPING**
J. Martinec (Federal Inst. for Snow and Avalanche Res., Davos, Switzerland) and Albert Rango, Principal Investigators *In its* Operational Appl. of Satellite Snowcover Observations May 1980 p 223-238 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57189 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A snow runoff model developed for European mountain basins was used with LANDSAT imagery and air temperature data to simulate runoff in the Rocky Mountains under conditions of large elevation range and moderate cloud cover (cloud cover of 40% or less during LANDSAT passes 70% of the time during a snowmelt season). Favorable results were obtained for basins with area not exceeding serval hundred square kilometers and with a significant component of subsurface runoff.

**N80-25756*#** Ecosystems International, Inc., Gambrills, Md.
**COST/BENEFIT ANALYSIS FOR THE OPERATIONAL APPLICATIONS OF SATELLITE SNOWCOVER OBSERVATIONS (OASSO)**
Peter A. Castruccio, Harry L. Loats, Jr., Donald Lloyd, and Pixie A. B. Newman, Principal Investigators *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 239-254 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. The total cost associated with satellite snow cover area measurement (SATSCAM) in the Colorado ASVT was $2,050 which equates to 0.22/sq km. When extrapolated to the 2,238,890 km area impacted by snow-survey forecasting in the Western United States, the total yearly cost of employing SATSCAM is approximately $493k. The estimated total benefits to hydroeletric energy production is $10m yearly, with the Pacific Northwest receiving the smallest benefits, and the Rio Grande region the highest. Irrigated agriculture receives a yearly total benefit of $38m, with the Lower Colorado region receiving the largest per acre benefit and the Pacific Northwest receiving the lowest.

**N80-25757*#** National Environmental Satellite Service, Washington, D. C.
**SNOW EXTENT MEASUREMENTS FROM GEOSTATIONARY SATELLITES USING AN INTERACTIVE COMPUTER SYSTEM**
R. S. Gird, Principal Investigator *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 255-265 refs ERTS

(Contract NAS5-21798)
Avail: NTIS HC A13/MF A01 CSCL 08L

The author has identified the following significant results. A time series of GOES full resolution visible image sectors was viewed on the McIDAS video component in chronological order and registered to within plus or minus 1 image pixel to compute real time snow melting rates. Synoptic scale clouds were eliminated to create a snow covered area from a composite image. Results show good agreement with NESS products although a significant difference was noted for one two-day period when the NESS products showed an increase in the snow cover for the Verde Basin, while the GOES/McIDAS product implied no change in the snow cover for approximately the same period. A check of NWS radar reports indicated no precipitation had occurred within the Verde basin. The use of the registered image sequence eliminates instrument error since small changes in the snow cover between any two days are easily detected.

**N80-25758*#** National Environmental Satellite Service, Washington, D. C.
**AN ALL-DIGITAL APPROACH TO SNOW MAPPING USING GEOSTATIONARY SATELLITE DATA**
J. D. Tarpley, Stanley B. Schneider, Principal Investigators, Edwin J. Danaher, and Gordon I. Myers *In* NASA. Goddard Space Flight Center Operational Appl. of Satellite Snowcover Observations May 1980 p 267-279 refs Original contains imagery. Original photography may be purchased form the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-25759*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A REVIEW OF LANDSAT-D AND OTHER ADVANCED SYSTEMS RELATIVE TO IMPROVING THE UTILITY OF SPACE DATA IN WATER-RESOURCES MANAGEMENT**
V. V. Salomonson and D. K. Hall, Principal Investigators *In its* Operational Appl. of Satellite Snowcover Observation May 1980 p 281-296 refs ERTS

Avail: NTIS HC A13/MF A01 CSCL 08L

**N80-26731*#** National Environmental Satellite Service, Washington, D. C.
**APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report**
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 31 Mar. 1980 3 p Sponsored by NASA HCMM
(E80-10144; NASA-CR-163162) Avail: NTIS HC A02/MF A01 CSCL 08H

**N80-26732*#** Environmental Research and Technology, Inc., Concord, Mass.
**INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1980**
James C. Barnes, Principal Investigator Apr. 1980 17 p HCMM
(Contract NAS5-24316)
(E80-10145; NASA-CR-163163; QPR-10) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Analysis of HCMM digital thermal data for daytime passes over the Salt-Verde Watershed area on five dates show a gradual depletion of snow cover in the watershed (and in the Little Colorado Watershed to the north) from a maximum on February 9th to a nearly complete disappearance of the snow pack by April 15th. Temperature contours correspond closely with the snowline observed in the visible image

**N80-26738*#** South Dakota State Univ., Brookings. Remote Sensing Inst.
**HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Progress Report, Jan. - Mar. 1980**
Donald G. Moore, Principal Investigator and J. L. Heilman Mar. 1980 7 p HCMM
(Contract NAS5-24206)
(E80-10155; NASA-CR-163172; SDSU-RSI-80-03) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. Day thermal data were analyzed to assess depth to groundwater in the test site. HCMM apparent temperature was corrected for atmospheric effects using lake temperature of the Oahe Reservoir in central South Dakota. Soil surface temperatures were estimated using an equation developed for ground studies. A significant relationship was found between surface soil temperature and depth to groundwater, as well as between the surface soil-maximum air temperature differential and soil water content (% of field capacity) in the 0 cm and 4 cm layer of the profile. Land use for the data points consisted of row crops, small grains, stubble, and pasture.

**N80-26746*#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**MICROWAVE REMOTE SENSING OF SNOWPACKS Final Report**
William H. Stiles and Fawaz T. Ulaby Jun. 1980 438 p refs
(Contract NAS5-23777)
(NASA-CR-3263) Avail: NTIS HC A19/MF A01 CSCL 08L

The interaction mechanisms responsible for the microwave backscattering and emission behavior of snow were investigated, and models were developed relating the backscattering coefficient (sigma) and apparent temperature (T) to the physical parameters of the snowpack. The microwave responses to snow wetness, snow water equivalent, snow surface roughness, and to diurnal variations were investigated. Snow wetness was shown to have an increasing effect with increasing frequency and angle of incidence for both active and passive cases. Increasing snow wetness was observed to decrease the magnitude sigma and increase T. Snow water equivalent was also observed to exhibit a significant influence sigma and T. Snow surface configuration (roughness) was observed to be significant only for wet snow surface conditions. Diurnal variations were as large as 15 dB for sigma at 35 GHz and 120 K for T at 37 GHz. Simple models for sigma and T of a snowpack scene were developed in terms of the most significant ground-truth parameters. The coefficients for these models were then evaluated; the fits to the sigma and T measurements were generally good. Finally, areas of needed additional observations were outlined and experiments were specified to further the understanding of the microwave-snowpack interaction mechanisms. A.R.H.

**N80-26755#** World Meteorological Organization, Geneva (Switzerland).
**APPLICATIONS OF REMOTE SENSING TO HYDROLOGY**
R. D. Wiesnet, V. G. Konovalov, and S. I. Solomon 1979 62 p refs
(WMO-513; ISBN-92-62-10513-8) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 10

The application of remote sensing to the collection of data on surface waters and related water balance elements is considered. The principles and techniques used are reviewed and the nature of the results obtained and their application are discussed. The various types of sensor, data-transmission systems and remote-sensing platforms which are used to obtain data on different hydrological elements are described. The practical application of remote sensing of surface water, lakes, snow, glaciers, precipitation and soil moisture is discussed. Subjects such as the use of meteorological radar of natural gamma radiation for remote sensing are dealt with to a limited extent. To determine the state-of-the-art in remote sensing of hydrological elements, a questionnaire was sent to selected members on WMO. A summary of the infividual replies to this questionnaire is appended. Author (ESA)

**N80-27742#** Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
**ICE SHEETS, GLACIERS, AND CLIMATE**
L. Lliboutry *In* ESA On Climatol., Hydrol., Atmospheric Res. and Meteorol. Res. (CHARM) from Space Feb. 1980 p 67-71 refs
Avail: NTIS HC A10/MF A01

Main problems of glacier and ice sheet dynamics are reviewed. A correlation between mass balances and meteorological factors is given. The importance of unusual synoptic situations or unusual sea ice cover in June-July-August is pointed out (e.g., quaternary ice sheets may have started on shallow seas). Results show that the thickness of an ice sheet of given width is much more sensitive to mass balance and air temperatures than often assumed. Spatial geodesy is suggested as useful to check numerical calculations of flow, but can give altitude changes only in some special areas. Author (ESA)

**N80-27794#** National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Glaciology.
**INVENTORY OF SNOW COVER AND SEA ICE DATA**
R. G. Crane, comp. Dec. 1979 166 p
(PB80-164007; GD-7; NOAA-80022901) Avail: NTIS HC A08/MF A01 CSCL 08L

Snow cover and sea ice data were surveyed with emphasis on map series or data sets which characterize these two cryospheric parameters on a regional to global scale. Such information is of broad relevance to problems of global climate, hydrology, and environmental monitoring, as well as for operational and planning purposes in conjunction with engineering projects, transportation, agriculture, and energy assessments. The present inventory is primarily concerned with sets of large-scale snow cover data. A summary of data available from the State Snow Surveys and from a few of the regional-scale operational and experimental snow cover data sets is included. Some national data sets from non-U.S. sources are also described. The inventory of sea ice data sources focuses on mapped information relating to the seasonal cycle. GRA

## 07

## DATA PROCESSING AND DISTRIBUTION SYSTEMS

**Includes film processing, computer technology, satellite and aircraft hardware, and imagery.**

**A80-35572 Threshold selection for line detection algorithms.** C. M. Gurney (Reading, University, Reading, Berks., England). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-18, Apr. 1980, p. 204-211. 16 refs. Research supported by the Atomic Energy Research Establishment.

Local operators are used to detect linear features in Landsat data for an area where such features are typically less than 1 pixel in width. A modification to existing techniques is made which gives improved results. The choice of threshold for the detector algorithm is investigated by considering line and background intensity, linewidths, and line alignment with respect to the pixel boundaries and spatial autocorrelation in the data set. It is found that results will always contain a significant amount of noise. Two postprocessing techniques are described which reduce this noise by utilizing contextual information in the data. (Author)

**A80-36415 # The inference of GATE convective rainfall from SMS-1 imagery.** W. L. Woodley, C. G. Griffith, J. S. Griffin, and S. C. Stromatt (NOAA, National Hurricane and Experimental Meteorology Laboratory, Coral Gables, Fla.). *Journal of Applied Meteorology,* vol. 19, Apr. 1980, p. 388-408. 7 refs. NOAA-supported research.

Quantitative precipitation estimates have been made for GATE from geosynchronous IR imagery, using a computer-aided technique. The present paper deals with the development and use of this technique for estimating rainfall from satellite imagery, using the A scale (in view of rain estimation on a scale of 1.4 x 10 to the seventh sq km). However, satellite rain estimates over smaller areas were compared with those provided independently by other investigators to establish the credibility of the satellite-derived rain estimates. The results of this research work are summarized, and some cases of interest are discussed. V.P.

**A80-38600 Use of satellite data for rapid preparation of thematic maps (Einsatz von Satellitendaten zur schnellen Herstellung thematischer Karten).** D. Bannert, R. W. Scholz (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany), and G. Pöhlmann (Berlin, Technische Fachhochschule, Berlin, West Germany). *Bildmessung und Luftbildwesen,* vol. 47, Sept. 1, 1979, p. 157-160. 5 refs. In German.

A procedure is presented which allows the printing of multicolored thematic maps within a few hours after the classification of the data on Landsat computer compatible tapes. Aspects discussed include preparatory steps towards classification, classification of digital image data, deriving printed forms from the modified magnetic tapes, and the printing of thematic maps with an abbreviated color scale. Examples for future applications are considered. In addition, a proof map is included. M.E.P.

**A80-38809 # The data management for remote sensing satellites.** J. P. Antikidis (ESA, Earth Observation Programme Office, Toulouse, France). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings.

Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 293-302.

Some of the efforts planned by the European Space Agency (ESA) for the development of systems in which instruments and processing are defined as a whole are presented. Attention is given to three fields of activity: quantitative information, standardization, and data management. Aspects examined include: on-board data handling, transmission, and ground acquisition and preprocessing. M.E.P.

**A80-38810 # A mathematical model for thermal inertia mapping by infrared imagery.** S. R. J. Axelsson (Saab-Scania AB, Linkoping, Sweden). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings.

Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 303-312. 5 refs.

A mathematical model of the surface temperature of a periodically heated half-space is developed to aid in the interpretation of thermal inertia maps obtained from infrared imagery. The analytical model, which is based on that of Watson (1975) for remote sensing applications, considers the effects of emissivity, albedo, thermal inertia, atmospheric heat exchange and the Fourier components of air temperature and incident radiation, and an explicit solution for surface temperature is obtained by linearizing the boundary conditions with a minimal error. A sensitivity analysis of the model indicates that thermal inertia is most sensitive to variations in albedo, incident radiation and atmospheric exchange, and means for correcting for the influence of these factors in the construction of an accurate thermal inertia map are suggested. A.L.W.

**A80-38813 # Considerations and examples on the geometrical correction of the images acquired by the MSS system of the Landsat satellite (Considerazioni ed esempi sulla correzione geometrica delle immagini riprese dal sistema MSS del satellite Landsat).** A. Moccia and S. Vetrella (Napoli, Università, Naples, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 335-343. 7 refs. In Italian.

A description is presented of the CATART interactive digital analysis system, and particularly of geometric correction and registration procedures. Methods based on the a priori correction of well predicted errors, or a transformation using ground control points allowing the reduction of residual errors, are considered. Emphasis is placed on the a priori correction of Landsat MSS data. A practical example is presented, showing monitor, line printer, and plotter outputs of the island of Capri; attention is given to establishing the gray tone to be assigned. J.P.B.

**A80-38856 # Some high-efficiency processing techniques for remotely sensed data (Alcune tecniche di elaborazione ad alta efficienza di dati di telerilevamento).** V. Cappellini, M. Fondelli (Firenze, Università, Florence, Italy), F. Muntoni, and F. Vanni (Nuovo Pignone S.p.A., Florence, Italy). In: Electronic systems for remote sensing and ranging; International Scientific Congress on Electronics, 27th, Rome, Italy, March 10-12, 1980, Proceedings.

Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 345-355. 8 refs. In Italian.

Some efficient digital techniques, based on digital filtering, local space operators and data compression algorithms are presented for remotely sensed data processing. In particular it is shown how, by means of two-dimensional digital filters, it is possible to perform enhancement and noise reduction on the remotely sensed images. Furthermore, by means of some local space operators it is possible to extract boundaries and edges in order to perform, with simple pattern recognition algorithms, a clear identification and classification of different image parts. A technique based on digital filtering and decimation is also presented for the comparison and correlation of earth maps obtained from sensors at different heights (aboard aircraft or satellites). Applications of the above techniques are shown to process aircraft photos and Landsat images for agriculture and water resource evaluations. (Author)

**A80-38859** # **From data to information (Dal dato all' informazione).** G. Pietroforte (Inforav, Rome, Italy). In: Electronic systems for remote sensing and ranging; International Scientific Congress on Electronics, 27th, Rome, Italy, March 10-12, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 385-391. In Italian.

The arrangement of remotely sensed data in such areas as meteorology, resources, and pollution into information relevant to particular users is discussed. Emphasis is placed on the intermediate phase, wherein data entered into a computer are organized into complex information which is more useful and efficient. Primarily, the assurance that the data are recorded maintaining their original nature as well as providing dynamic responses to the specific requirements of the users is considered. J.P.B.

**A80-39211** **Recommended modification of LOWTRAN 4 to include first order solar scattering.** L. L. Smith, J. Krassner, W. G. Egan, T. W. Hilgeman, and J. E. A. Selby (Grumman Aerospace Corp., Bethpage, N.Y.). In: Atmospheric effects on radiative transfer; Proceedings of the Seminar, San Diego, Calif., August 29, 30, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 60-69. 13 refs.

The atmospheric transmittance and radiance code LOWTRAN 4 is modified to include first order scattering of sunlight into the line of sight. This scattering becomes important for wavelengths shorter than 5 microns under daytime conditions. The radiance due to both aerosol and molecular scattering is combined with atmospheric extinction and thermal emission already contained in the model. A mean phase function is defined by averaging over a given aerosol size distribution, composition, and wavelength in order to simplify the calculations. A comparison of the model with observational data is presented. (Author)

**A80-39711** **Automatic change detection for synthetic aperture radar images.** J. Keng (Lockheed Research Laboratories, Palo Alto, Calif.). In: Applications of digital image processing III; Proceedings of the Seminar, San Diego, Calif., August 27-29, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 125-128.

The detection of changes between two images is of interest in a wide range of applications. An important example is side-looking Synthetic Aperture Radar (SAR) imagery taken at different times. A method called Symbolic Matching with Confidence Evaluation is proposed to perform automatic change detection for SAR images. The results of the preliminary experiments have been very promising and will be presented. (Author)

**A80-39741** **SAR processing of partially coherent phenomena.** R. K. Raney (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). *International Journal of Remote Sensing,* vol. 1, Jan.-Mar. 1980, p. 29-51. 9 refs. Research supported by the Department of Energy, Mines, and Resources.

The general problem of a partially coherent synthetic aperture radar (SAR) imaging a scene that is subjected to random fade is considered. The impulse response, frequency response and response to extended random fields are formally derived. Explicit results are obtained using gaussian functions to describe the SAR, its coherence and the scene coherence. Results converge appropriately on known results for cases treated previously. New results are presented concerning all three classes of fading input scenes. The results are applied to the problem of SAR imagery of oceanic waves, with comments on certain aspects of Seasat-A SAR data as appropriate. (Author)

**A80-39744** **Relative reflectance data from preprocessed multispectral photography.** P. Curran (Reading, University, Reading, Berks., England). *International Journal of Remote Sensing,* vol. 1, Jan.-Mar. 1980, p. 77-83. 12 refs. Natural Environment Research Council Grant No. GR-3/1481.

A preprocessing methodology for the acquisition of quantitative relative reflectance data from multispectral multitemporal photography is proposed. The technique serves to suppress frame-to-frame and date-to-date variability, which influence the relationship between reflectance and photographic image tone, by the steps of gamma standardization, scene-to-scene ratioing and band-to-band ratioing. An example of the preprocessing of ground-level and aerial photography of four types of vegetation cover taken at regular intervals demonstrates the close covariance of the data sets with respect to each other and to seasonal variations in biomass and ground cover. The methodology has applications in all situations requiring quantitative relative reflectance data to be obtained economically from photographic data. A.L.W.

**A80-39853** # **Development of methods and tools for subsatellite observations (Razvitie metodov i sredstv podsputnikovykh nabliudenii).** T. K. Ismailov (Akademiia Nauk Azerbaidzhanskoi SSR, Institut Kosmicheskikh Issledovanii Prirodnykh Resursov, Baku, Azerbaidzhan SSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 35-39. In Russian.

The principles of a subsatellite system for the remote sensing of earth resources are reviewed, with attention given to the thematic interpretation of large files of remote sensing data and the detailed investigation of polygon characteristics. As an example, the features of a subsatellite service introduced in the Caucasus-Caspian area are described. B.J.

**A80-39854** # **The development and utilization of aerospace studies of natural phenomena and resources in Siberia and the Far East (Razvitie i ispol'zovanie aerokosmicheskikh issledovanii prirodnykh iavlenii i resursov v Sibiri i na Dal'nem Vostoke).** A. L. Ianshin and L. K. Ziat'kova (Akademiia Nauk SSSR, Institut Geologii i Geofiziki, Novosibirsk, USSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 40-48. 30 refs. In Russian.

The use of aerial and space photographic data for the investigation of natural resources and processes in Siberia and the Far East is reviewed. Attention is given to biological, geological, and geographical investigations, and to the processing and thematic interpretation of remote sensing data by means of computer systems. B.J.

**A80-39859** # **Thematic interpretation of multispectral space photographs (Tematicheskoe deshifrirovanie mnogozonal'nykh kosmicheskikh snimkov).** Iu. F. Knizhnikov and V. I. Kravtsova (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 88-94. 11 refs. In Russian.

The advantages and disadvantages of multispectral space photography are reviewed, along with a brief history of its application, and specific features of the interpretation of multispectral imagery. Four major approaches to data handling are assessed: (1) the interpretation of selected spectral images, (2) the interpretation of color transparencies, (3) the successive interpretation of a multispectral image series, and (4) the comparative interpretation of the multispectral series on the basis of the object's spectral signature. B.J.

**A80-40831** **Remote sensing and image interpretation.** T. M. Lillesand (Minnesota, University, Minneapolis, Minn.) and R. W. Kiefer (Wisconsin, University, Madison, Wis.). New York, John Wiley and Sons, Inc., 1979. 624 p. 166 refs. $26.95.

The book has been prepared for use in remote sensing and image interpretation studies. It focuses on remote sensing systems and illustrates their utility in a diverse range of data gathering applications. The book is divided into 10 chapters: (1) concepts and foundations of remote sensing; (2) elements of photographic systems; (3) introduction to airphoto interpretation; (4) airphoto interpretation for terrain evaluation; (5) photogrammetry; (6) radiometric characteristics of aerial photographs; (7) aerial thermography; (8) multispectral scanning and spectral pattern recognition; (9) microwave sensing; and (10) remote sensing from space. Image sources are given in an appendix. S.D.

**A80-40836** **Landsat image processing.** E. E. Triendl (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany). In: Advances in digital image processing: Theory, application, implementation; Proceedings of the International Symposium, Bad Neuenahr, West Germany, September 26-28, 1978. New York, Plenum Press, 1979, p. 165-175.

Landsat image processing is reviewed, with attention given to the multispectral scanner, and the geometric and radiometric properties of multispectral scanner pictures. It is noted that geometric rectification and pixel by pixel classification of Landsat MSS imagery are fairly well understood. More advanced methods of picture segmentation are very promising but still in the development stage. B.J.

**A80-41296** # **Problems of the aerial and space spectrometry of the earth surface (Problemy aerokosmicheskoi spektrometrii zemnoi poverkhnosti).** G. A. Avanesov (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1980, p. 66-75. 12 refs. In Russian.

The development of automatic image processing systems for remotely sensed data is considered with emphasis on the interpretation of multispectral data. Attention is given to the development of a data bank which would relate the spectral energy and textures of objects with their physical and chemical characteristics. The physical, methodological, and technical aspects of the problem are discussed. B.J.

**A80-41302** **Distributed processing system for remotely sensed data analysis in developing nations.** H. L. Wagner (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 17-21.

A distributed processing system for remotely sensed data is proposed which consists of a large time-shared computer mainframe for the bulk of image manipulation and processing, and a small microprocessor-based intelligent terminal for image display and interpretation. Features of the system include portability enabling in-field use and low cost. Consequently, a user could obtain processed imagery at remote locations either by telephone links or satellite relay. J.P.B.

**A80-41303** **A French satellite for remoting sensing - A study of the geometric quality of the images.** A. P. Esterle and R. C. Rosso (Centre National d'Etudes Spatiales, Toulouse, France). In: Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 31-44. 6 refs.

The SPOT remote sensing satellite project is described, including its mission, orbit, payload and image station; a complete coverage of the earth's surface will be made in 26 days, and two HRV scanning instruments will be used. In order to assess the geometric quality of the images obtained, a computer simulation was carried out which gave the sensitivity of the images to different parameters. After correction the images are scaled to ensure the superposability on a reference map. Results indicate that the scales will be 1:1,000,000 after preprocessing, and 1:500,000 or 1:250,000 according to whether three or nine ground control points are used. J.P.B.

**A80-41665** **Site-specific mapping of surface temperature based on NOAA-5 satellite VHRR data.** S. Khorram and H. G. Smith (California, University, Berkeley, Calif.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 61-72. 5 refs.

The procedure used in this study involved: (1) geometric correction of the satellite data, because of distortions caused by curvature of the earth's surface, earth rotation and satellite movement; (2) temperature calibration; (3) coordinate transformation for compatibility with other data sources; and (4) preparation of temperature maps with watershed boundaries on them. This procedure has been applied to the study area for several dates during the spring of 1978. Output products include geometrically corrected thermal imagery, temperature maps, statistical summaries and tabulated temperature values for the entire study area. The output products are presently being implemented into selected net radiation and hydrologic models. (Author)

**A80-41671** **The errors associated with digital resampling of Landsat forest imagery for multidate registration.** T. L. Logan (Informatics, Inc., Pasadena, Calif.) and A. H. Strahler (California, University, Santa Barbara, Calif.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 163-180.

The degradation of Landsat imagery by resampling for registration (or rectification) was found to vary considerably depending on whether the cubic convolution, bilinear, or nearest neighbor technique was used. In a 220 sq km study area located within California's Klamath National Forest, the cubic convolution technique was found to introduce the least amount of error in twice-resampled imagery, with 14% of Band 5 pixels and 22% of Band 7 pixels altered by 3 density numbers (DN) or more. This compares to 35% and 44%, respectively, for the same imagery resampled with the bilinear algorithm. Nearest neighbor sampling best preserved the original histogram of DN values, but proved unfit for multidate registration owing to poor spatial relocation of pixels. B.J.

**A80-41764** # **The microwave remote sensing experiment for the first Spacelab payload.** W. Wodsak (Dornier System GmbH, Friedrichshafen, West Germany) and M. Wahl (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Cologne, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt and American Astronautical Society, Symposium on Shuttle/Spacelab - The New Transportation System and its Utilization, 3rd, Hanover, West Germany, Apr. 28-30, 1980, DGLR Paper 80-090.* 24 p.

The organization and block diagram of a Spacelab remote sensing experiment are examined. The discussion is centered on the three basic modes of the experiment - the two-frequency (2 FS) mode for obtaining ocean wave spectra; the SAR (Synthetic Aperture Radar) mode, aimed at obtaining data for processing earth images with a resolution on the order of 25 m; and the radiometer mode, intended to support the two previous modes by measuring the 9.6 GHz radiation of the earth. V.P.

**N80-23715*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): USER'S GUIDE**

A. M. Fails, Principal Investigator Dec. 1979 77 p ERTS
(Contract NAS9-15800)
(E80-10088; NASA-CR-160531; LEC-14286; JSC-16436)
Avail: NTIS HC A04/MF A01 CSCL 08F

**N80-23716*#** Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
**A METHOD FOR CLASSIFYING MULTISPECTRAL REMOTE SENSING DATA USING CONTEXT**
Philip H. Swain, Howard J. Siegel, and Bradley W. Smith, Principal Investigators 1979 11 p refs Presented at the Machine Process of Remotely Sensed Data Symp., 1979 ERTS
(Contract NAS9-15466)
(E80-10089; NASA-CR-160477; Rept-062379) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-23717*#** Lockheed Electronics Co., Houston, Tex.
**OPERATIONS MANUAL FOR THE LANDSAT IMAGERY, VERIFICATION AND EXTRACTION SYSTEM (LIVES)**
L. E. Giddings, Principal Investigator Aug. 1979 83 p ERTS
(Contract NAS9-15800)
(E80-10090; NASA-CR-160475; LEC-12903; JSC-14633) Avail: NTIS HC A05/MF A01 CSCL 05B

**N80-23718*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**USERS MANUAL FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)**
L. E. Giddings, Principal Investigator Aug. 1979 52 p ERTS
(Contract NAS9-15800)
(E80-10091; NASA-CR-160474; LEC-12902; JSC-14632) Avail: NTIS HC A04/MF A01 CSCL 05B

**N80-23723*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): UNIVAL SOFTWARE USER'S GUIDE**
A. S. Story and M. V. Martin, Principal Investigators Dec. 1979 55 p ERTS
(Contract NAS9-15800)
(E80-10096; NASA-CR-160532; LEC-14287; JSC-16437) Avail: NTIS HC A04/MF A01 CSCL 08F

**N80-23724*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): ACCEPTANCE TEST PROCEDURES**
M. L. Brown, M. V. Martin, and A. S. Story, Principal Investigators Dec. 1979 52 p ERTS
(Contract NAS9-15800)
(E80-10097; NASA-CR-160533; LEC-14288; JSC-16438) Avail: NTIS HC A04/MF A01 CSCL 08F

**N80-24730#** Army Engineer Topographic Labs., Fort Belvoir, Va.
**DETECTION OF SIGNAL SIGNATURES OF CARTOGRAPHIC FEATURES**
Pi-Fuay Chen and William Seemuller 17 Jan. 1980 19 p refs
(AD-A082235; ETL-R006) Avail: NTIS HC A02/MF A01 CSCL 08/2

A semi-automated technique was developed for extracting and recognizing cartographic features, such as, road intersections, straight line roads, and rectangular objects from aerial photographs. The method uses the Walsh transform processing technique, and was implemented with an electronic experimental system consisting of a solid-state sensor array, a minicomputer, and a computer-controlled translational stage as the imagery holder. Successful experimental results were obtained for a selected set of cartographic features of the types described above. This feature extractor will be integrated in parallel with other feature extractors, which are to be developed in the future, to become a total automated feature extraction system. A method for detecting the decomposed signal signatures representing cartographic features using analog processors is described. Finally, conclusions are given. GRA

**N80-24738#** Royal Aircraft Establishment, Farnborough (England).
**GEOMETRIC CORRECTION OF SATELLITE IMAGERY**
J. M. Williams London HMSO Sep. 1979 31 p refs
(RAE-TR-79121; RAE-Space-569; BR72781) Avail: NTIS HC A03/MF A01

Imagery from LANDSAT and other remote sensing satellites suffers geometric distortion which requires correction. How ground control points can be used to determine the transformation between image coordinates and some known projection is described. These ground control points were located in the image and on a standard map, here a 1:50,000 ordnance survey map. Suitable models for performing the transformation and various interpolation techniques for resampling the transformed image are examined. As results, a set of photographic images is included to show the effects of the processing methods described. Author (ESA)

**N80-25021*#** Science Systems and Applications, Inc., Lanham, Md.
**A COMPUTER ALGORITHM FOR PERFORMING INTERACTIVE ALGEBRAIC COMPUTATION ON THE GE IMAGE-100 SYSTEM Final Report**
William D. Hart and H. H. Kim 1979 32 p refs
(Contract NAS5-25113)
(NASA-CR-159985) Avail: NTIS HC A03/MF A01 CSCL 09B

A subroutine which performs specialized algebraic computations upon ocean color scanner multispectral data is presented. The computed results are displayed on a video display. The subroutine exists as a component of the aircraft sensor analysis package. The user specifies the parameters of the computations by directly interacting with the computer. A description of the conversational options is also given. M.G.

**N80-26059#** Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
**ALGORITHMS FOR SAMPLE CLASSIFICATION AND IMAGE FEATURE SELECTION [ALGORITMOS PARA CLASSIFICACAO DE AMOSTRAS E SELECAO DE ATRIBUTOS DE IMAGENS]**
Carlos Roberto deSouza, Luiz Rogerio deCamargos, Ravindra Kumar, and Nelson D. A. Mascarenhas Apr. 1980 88 p refs In PORTUGUESE; ENGLISH summary
(INPE-1718-RPE/124) Avail: NTIS HC A05/MF A01

Two algorithms are described for sample classification in Earth resources multispectral imagery. The first one uses the JM-distance, while the second one is based on the maximum likelihood criterium. A feature selection algorithm was also implemented under the following criteria: average JM-distance and minimum JM-distance. A.R.H.

**N80-26060#** Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
**PARTITIONING MULTISPECTRAL IMAGERY OF THE EARTH RESOURCES [PARTICIONAMENTO DE IMAGENS MULTIESPECTRAIS DE RECURSOS NATURAIS DA TERRA]**
Walter Kenkiti Takahashi, Adeel Woods DecFilho, and Ravindra Kumar Feb. 1980 65 p refs In PORTUGUESE; ENGLISH summary
(INPE-1678-RPE/111) Avail: NTIS HC A04/MF A01

An efficient algorithm is described for partitioning multispectral Earth resources imagery. Statistically homogeneous objects are extracted, for posterior classification. A.R.H.

**N80-26715*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): AS BUILT FUNCTIONAL DESIGN**
M. L. Brown, A. M. Fails, M. V. Martin, A. S. Story, and E. A. Weisblatt, Principal Investigator Jan. 1980 115 p ERTS
(Contract NAS9-15800)
(E80-10125; NASA-CR-160561; LEMSCO-13258; JSC-16458) Avail: NTIS HC A06/MF A01 CSCL 05B

**N80-26720*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**AN EXAMINATION OF SPECTRAL BAND RATIONING TO REDUCE THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA**
Brent Holben and Chris Justice, Principal Investigator Feb. 1980 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10133; NASA-TM-80640) Avail: NTIS HC A03/MF A01 CSCL 14E

**N80-26724*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 1: SYSTEM OVERVIEW**
P. J. Aucoin and J. Stewart, Principal Investigator Aug. 1978 226 p ERTS
(Contract NAS9-15200)
(E80-10137; NASA-CR-160595; LEC-12563-Vol-1; JSC-13821-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 05B

**N80-26725*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 2: USER'S REFERENCE MANUAL**
P. J. Aucoin, Principal Investigators and J. Stewart Dec. 1978 307 p refs ERTS
(Contract NAS9-15200)
(E80-10138; NASA-CR-160594; LEC-12564-Vol-2; JSC-13821-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 05B

**N80-26726*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**EARTH OBSERVATIONS DIVISION VERISON OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 4: PROGRAM LISTINGS**
M. L. Burnell and P. J. Aucoin, Principal Investigator Jan. 1979 527 p ERTS
(Contract NAS9-15800)
(E80-10139; NASA-CR-160592; LEC-12565-Vol-4; JSC-13821-Vol-4) Avail: NTIS HC A23/MF A01 CSCL 05B

**N80-26727*#** Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
**EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 4: PROGRAM LISTINGS**
M. L. Burnell and P. J. Aucoin, Principal Investigator Nov. 1979 535 p Revised ERTS
(Contract NAS9-15800)
(E80-10140; NASA-CR-160572; LEC-12566-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A23/MF A01 CSCL 05B

**N80-26737*#** Environmental Research Inst. of Michigan, Ann Arbor.
**LANDSAT TECHNOLOGY TRANSFER USING COMMUNITY COLLEGES Progress Report, Jan. - Apr. 1980**
Robert H. Rogers, Principal Investigator May 1980 48 p ERTS
(Contract NASw-3308)
(E80-10154; NASA-CR-163171; ERIM-147200-4-P) Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-26748#** Geological Survey, Washington, D. C.
**INTRODUCTION TO MONITORING DYNAMIC ENVIRONMENTAL PHENOMENA OF THE WORLD USING SATELLITE DATA COLLECTION SYSTEMS, 1978**
William D. Carter and Richard W. Paulson 1979 26 p refs
(Circ-803) Avail: NTIS HC A03/MF A01

Satellite telemetry systems that can collect and transmit environmental data from remote regions of the world to regional resources information centers are described. The features and limitations of global information systems are discussed with respect to instrumentation. R.C.T.

**N80-26758#** New Mexico Univ., Albuquerque.
**REMOTE SENSING: PHOTOINTERPRETATION TECHNIQUES OF LANDSAT DATA. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jan. 1980**
Robert W. Gonzales Mar. 1980 40 p Sponsored in cooperation with NASA and NTIS
(PB80-805484) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

Various aspects of photointerpretation of LANDSAT data are considered in 152 abstracts of reports on photomapping, geologic and soil investigations, effect of vegetation on rock and soil, ecological land classification, forestry, terrain and crop analysis, and additive viewing as an interpretation technique. GRA

**N80-27096#** Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
**THE COMPUTER IN PHYSICAL GEOGRAPHY [DE COMPUTER IN DE FYSISCH GEOGRAFIE]**
1979 118 p refs In DUTCH Proc. held in Amsterdam, 14 Apr. 1978
Avail: NTIS HC A06/MF A01

Topics include: computerized modeling and simulation, image processing of satellite photographs, on-line literature searching, processing of metrology data, and statistical analysis of geographical data.

**N80-27768*#** Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
**AS-BUILT SPECIFICATION FOR THE ERIM TAPE CONVERSION TO LARSYS 2 PROGRAM (ECTL2)**
L. F. Robinson, Principal Investigator Dec. 1976 25 p ERTS

(Contract NAS9-12200)
(E80-10202; NASA-CR-160614; LEC-9857; JSC-11833) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-27773*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**A NOTE ON THE GENERATION OF POISSON-DISTRIBUTED RANDOM NUMBERS WITH LARGE MEAN**
George R. Terrell, Principal Investigator Apr. 1980 11 p refs ERTS
(Contract NAS9-15800)
(E80-10224; NASA-CR-160656) Avail: NTIS HC A02/MF A01 CSCL 12A

**N80-27775*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 3: AS-BUILT DOCUMENTATION (SECTIONS 1-12)**
M. L. Burnell and P. J. Aucoin, Principal Investigators Apr. 1980 349 p ERTS
(Contract NAS9-15800)
(E80-10226; NASA-CR-160658; LEMSCO-12565-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A15/MF A01 CSCL 05B

**N80-27776*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
**EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 3: AS-BUILT DOCUMENTATION (SECTIONS 13-23)**
M. L. Burnell and P. J. Aucoin, Principal Investigators Apr. 1980 442 p ERTS
(Contract NAS9-15800)
(E80-10227; NASA-CR-160659; LEMSCO-12565-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A19/MF A01 CSCL 05B

# 08

# INSTRUMENTATION AND SENSORS

**Includes data acquisition and camera systems and remote sensors.**

**A80-33337 * #** **Microwave radar and radiometric remote sensing measurements of lake ice.** C. T. Swift, W. L. Jones, Jr., R. F. Harrington, J. C. Fedors, R. H. Couch (NASA, Langley Research Center, Hampton, Va.), and B. L. Jackson (Old Dominion University, Norfolk, Va.). *Geophysical Research Letters,* vol. 7, Apr. 1980, p. 243-246. 11 refs.

Simultaneous microwave radar and spectral radiometric data were collected over Lake Erie during March 1978. A theoretical development is presented which interprets the data collected at nadir in terms of changes in the ice thickness and the electromagnetic attenuation coefficient. The theory also addresses the failure of the spectral radiometer to determine ice thickness through observations of quarter wavelength excursions in the reflectivity. Radar data collected off-nadir showed a substantially different behavior compared to that collected near nadir. This difference is attributed to a change in propagation characteristics from quasi-specular return from the ice-water interface to scattering from the rough air-ice interface. (Author)

**A80-35298** **The field measurement of reflectance factors.** M. J. Duggin (New York, State University, Syracuse, N.Y.). *Photogrammetric Engineering and Remote Sensing,* vol. 46, May 1980, p. 643-647. 10 refs.

The literature contains reflectance factors which have been obtained in many different ways and which often disagree. The major error sources may be eliminated by using a simple relative measurement technique in which two radiometers are employed to measure simultaneously irradiance on the ground and radiance reflected from it. It is essential that the calibration between these radiometers and its dependence on sun angle be understood. This report deals with the problems of measurement, calibration, and analysis. Special emphasis is placed upon measurements made in the Landsat bandpasses. (Author)

**A80-36160 #** **The distant geomagnetic tail observing satellite Geos-3.** K. Knott (ESA, Space Science Dept., Noordwijk, Netherlands). *ESA Journal,* vol. 4, no. 1, 1980, p. 1-14.

The scientific rationale and mission objectives of a satellite devised to observe the geomagnetic tail at distances beyond 100 earth radii are examined. A discussion of the scientific payload covers the magnetometer, the high-energy-particle spectrometer, the gamma-ray burst detector, and plasma-mantle, plasma-sheet, plasma-composition, and wave-field experiments. The operational configuration of the Geos-3 is illustrated and described. V.P.

**A80-37405 * #** **An algorithm for retrieval of ocean surface and atmospheric parameters from the observations of the scanning multi-channel microwave radiometer.** T. T. Wilheit and A. T. C. Chang (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Radio Science,* vol. 15, May-June 1980, p. 525-544. 30 refs.

The scanning multichannel microwave radiometer is a five-frequency (6.6, 10.7, 18, 21, and 37 GHz), dual-polarized microwave radiometer, which was launched in two separate satellites, Nimbus 7 and Seasat, in 1978. A formalism is developed which can be used to interpret the data in terms of sea surface temperature, sea surface wind speed, and the atmospheric content of water vapor and liquid water. It is shown with reasonable instrumental performance assumptions that these parameters can be derived to useful accuracies. Although the algorithms are not derived for use in rain, it is shown that at least token rain rates can be tolerated without invalidating the retrieved geophysical parameters. (Author)

**A80-37774 *** **Some considerations in the evaluation of Seasat-A scatterometer /SASS/ measurements.** I. Halberstam (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Journal of Physical Oceanography,* vol. 10, Apr. 1980, p. 623-632. 28 refs. Contract No. NAS7-100.

A study is presented of the geophysical algorithms relating the Seasat-A scatterometer (SASS) backscatter measurements with a wind parameter. Although these measurements are closely related to surface features, an identification with surface layer parameters such as friction velocity or the roughness length is difficult. It is shown how surface truth in the form of wind speeds and coincident stability can be used to derive friction velocity or the equivalent neutral wind at an arbitrary height; it is also shown that the derived friction velocity values are sensitive to contested formulations relating friction velocity to the roughness length, while the derived values of the equivalent neutral wind are not. Examples of geophysical verification are demonstrated using values obtained from the Gulf of Alaska Seasat Experiment; these results show very little sensitivity to the type of wind parameter employed, suggesting that this insensitivity is mainly due to a large scatter in the SASS and surface truth data. A.T.

**A80-38795 #** **Operation of the microwave remote sensing experiment /MRSE/.** M. Werner and R. Fiedler (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 107-116.

The use of a multimode microwave sensor on Spacelab, with high data rates, automatization and a good interrupt possibility is discussed. The microwave remote sensing experiment (MRSE) consists of a microwave radar instrument in the X-band (9.65 GHz) with three experiment operation modes. In the first mode, MRSE operates as a two-frequency scatterometer for remote measurements of the ocean wave spectrum; the second mode is a high resolution synthetic aperture radar with all-weather earth surface imaging capability for hydrology, agriculture and cartography, and the passive mode is a Dicke radiometer measuring the microwave brightness temperature of the antenna footprint. The operation sequence, control and monitoring techniques, data handling and ground operations are discussed. J.P.B.

**A80-38804 #** **Programs of spaceborne remote sensing of the Consiglio Nazionale delle Ricerche (Programmi di teleosservazioni spaziali del Consiglio Nazionale delle Ricerche).** C. Albanesi (CNR, Servizio Attività Spaziali, Rome, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 231-235. In Italian.

Remote sensing programs of the U.S. (Landsat D), of ESA regarding agriculture, water resources, fishing and the marine environment, and of France and Germany are discussed, together with the national space plan of Italy. A feasibility study regarding the technology of microwave sensors is reported. Emphasis is placed on a pilot project for using remote sensing to determine water resources in relation to agrarian and forest productivity. The objects of the research include defining hydrogeologic balances, measuring evapotranspiration, evaluating thermal and water conditions of vegetation and of the terrain, and determining agrometeorological areas with regard to cultivation. J.P.B.

**A80-39125 Statistical scene study of Skylab infrared data.** E. M. Winter (IBM Corp., Westlake Village, Calif.). In: Modern utilization of infrared technology V; Proceedings of the Fifth Annual Seminar, San Diego, Calif., August 29, 30, 1979.
Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 225-232. 6 refs.

Four S-192 conical multiscanner data sets acquired during the 1973-1974 Skylab mission were investigated from the standpoint of the statistical properties of the scenes themselves. These S-192 data sets contained scene data not normally acquired by aircraft-based remote sensors; but represented in the data sets were several cloud types, coastal mountains, snow covered mountains and valleys, and ocean backgrounds. The data sets were studied by choosing areas of homogeneous background and obtaining the power spectral density (PSD). The statistics of like areas were compared, noting the effect of optically thin and thick clouds on the statistics of terrain backgrounds; the PSD's based on the Skylab-192 will be presented and infrared and statistical measures for specific background classes were discussed. A.T.

**A80-39860 # Remote sensing methods for investigating the earth's surface and atmosphere in the microwave range (Distantsionnye metody izucheniia zemnoi poverkhnosti i atmosfery zemli v SVCh diapazone radiovoln).** N. A. Armand (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 95-105. 6 refs. In Russian.

The application of active and passive radar sensing methods are demonstrated by examples of spaceborne remote sensing of the earth's surface and atmosphere. The theoretical principles of active and passive sensing are described, and some experimental results are presented. The promise of microwave radiometers, scatterometers, and altimeters for oceanography, meteorology, and environmental control is indicated. B.J.

**A80-39861 # The spectral reflectance characteristics of natural objects and their application in the remote sensing of the earth (Spektral'nye otrazhatel'nye kharakteristiki prirodnykh obrazovanii i ikh primenenie dlia tselei distantsionnogo issledovaniia zemli).** D. N. Mishev (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Kosmicheski Izsledvaniia, Sofia, Bulgaria). *Issledovanie Zemli iz Kosmosa,* Jan.-Feb. 1980, p. 106-113. 17 refs. In Russian.

A series of spectrometers has been developed at the Space Research Laboratory of the Bulgarian Academy of Sciences for the remote measurement of the spectral reflectance of the earth's surface. The principles of operation of these devices are reviewed, and their application for the classification and identification of objects on the earth's surface is examined. B.J.

**A80-39863 # Further development of methods for the observation of the earth from space (O dal'neishem razvitii metodov issledovaniia zemli iz kosmosa).** Ia. L. Ziman (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR). *Issledovanie Zeml iz Kosmosa,* Jan.-Feb. 1980, p. 125-133. 5 refs. In Russian.

The comprehensive remote sensing program of the Space Research Institute of the USSR Academy of Sciences is described; methodological principles are discussed along with the design and operation of onboard instrumentation. The instrumentation includes a unified video-spectrometry system for both aircraft and satellites, and a new type of system for surveys in several spatial frequency bands. B.J.

**A80-40698 # Optimal calibration of remote sensors from results of direct measurements in the ocean (Optimal'naia kalibrovka distantsionnykh priborov po rezul'tatam neposredstvennykh izmerenii v okeane).** S. V. Dotsenko and L. G. Salivon (Akademiia Nauk Ukrainskoi SSR, Institut Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR). *Meteorologiia i Gidrologiia,* Apr. 1980, p. 107-112. 9 refs. In Russian.

The paper describes a method for the optimal calibration of oceanographic remote sensors from direct measurement sensors. It is shown that the relative calibration error can be reduced considerably if the direct measurements are time-averaged with a certain optimal weight. The application of the technique to satellite (TIROS and Cosmos-149) radiometer measurements is considered as an example. B.J.

**A80-41298 # Evaluation of the information properties of space-photography materials and equipment (Voprosy otsenki informatsionnykh svoistv materialov i sredstv kosmicheskoi fotos'emki).** L. M. Matiiasevich (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1980, p. 84-91. 16 refs. In Russian.

Information theory is applied to the evaluation of the characteristics of spaceborne photographic remote sensing systems. The evaluation involves three stages: (1) the selection of information criteria, (2) the development of methods for determining the numerical values of criteria, and (3) the development methods for solving engineering problems on the basis of the selected criteria. B.J.

**A80-41540 * Solar occultation sounding of pressure and temperature using narrowband radiometers.** J. H. Park, J. M. Russell, III (NASA, Langley Research Center, Hampton, Va.), and M. A. H. Smith (College of William and Mary, Williamsburg, Va.). *Applied Optics,* vol. 19, July 1, 1980, p. 2132-2139. 11 refs. Grant No. NCC1-3.

A technique for simultaneously retrieving pressure and temperature profiles using satellite-based narrowband radiometer measurements of absorption in the CO2 4.3-micron band is described. Pressure and temperature profiles for earth's upper atmosphere on a global scale can be obtained with errors less than 3% and 3 K, respectively. The p-T information can be used not only for improving the accuracy of inverted gas concentrations in the same absorption experiment but also for investigating the upper atmosphere circulation. (Author)

**A80-41541 * Surface reflectance measurements in the UV from an airborne platform.** I. D. D. Doda and A. E. S. Green (Florida, University, Gainesville, Fla.). *Applied Optics,* vol. 19, July 1, 1980, p. 2140-2145. 29 refs. Contract No. NAS5-22980.

The reflectance of naturally occurring surfaces is measured from a twin engine Cessna 402B aircraft both spectrally (0.29-0.40 micron) with a compact double monochromator and broadband (0.29-1.2 micron) with a UV enhanced photodiode. The measurement system, which is computer controlled and electrically isolated from the aircraft, consists of upward and downward looking hemispheric diffusers, filters, a rotating 90 deg mirror, a focusing lens, and a double monochromator/PMT or the UV photodiode. Measurements are taken at several altitudes enabling the empirical determination of backscatter and attenuation effects on the reflectance. The results are presented for pine forest canopy, green farmland, open ocean, and brown farmland as a function of wavelength and altitude. (Author)

**A80-41765 # MOMS - The modular opto-electronic multispectral scanner programme development.** A. von Breitenstein (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt and American Astronautical Society, Symposium on Shuttle/Spacelab - The New Transportation System and its Utilization, 3rd, Hanover, West Germany, Apr. 28-30, 1980, DGLR Paper 80-092.* 14 p. 12 refs.

The development of the Modular Optoelectronical Multispectral System (MOMS) electronic camera is discussed, which offers remotely sensed line-by-line scanning of land and coastal/ocean features. The basic MOMS system is designed for an instantaneous field of view of 67.5 microrad, and at an orbit altitude of 296 km, the ground pixel size will be 20 m. Attention is given to the future development of a MOMS STEREO MODUL with stereoscopic capability, the development of MOMS spectral modules in the infrared range and the extension of the MOMS central control electronics for data compression and reduction. J.P.B.

**A80-42065 * #** **An initial assessment of the performance achieved by the Seasat-1 radar altimeter.** W. F. Townsend (NASA, Wallops Flight Center, Wallops Island, Va.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 80-92. 18 refs.

This paper describes the results of an initial on-orbit engineering assessment of the performance achieved by the radar altimeter system flown on Seasat-1. Additionally, the general design characteristics of this system are discussed and illustrations of altimeter data products are provided. The instrument consists of a 13.5-GHz monostatic radar system that tracks in range only using a 1-m parabolic antenna pointed at the satellite nadir. Two of its unique features are a linear FM transmitter with 320-MHz bandwidth, which yields a 3.125-ns time-delay resolution, and microprocessor-implemented closed-loop range tracking, automatic gain control (AGC), and real-time estimation of significant wave height (SWH). Results presented herein show that the altimeter generally performed in accordance with its original performance requirements of measuring altitude to a precision of less than 10-cm rms, SWH to an accuracy of plus or minus 0.5 m or 10 percent whichever is greater, and ocean backscatter coefficient to an accuracy of plus or minus 1 dB, all over an SWH range of 1 to 20 m. (Author)

**A80-42066 *** **Seasat altimeter sensor file algorithms.** D. W. Hancock, R. G. Forsythe (NASA, Wallops Flight Center, Wallops Island, Va.), and J. Lorell (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 93-99. 8 refs. Contract No. NAS7-100.

The Seasat altimeter is designed to measure three parameters important to oceanography: height of the spacecraft above the ocean surface, significant wave height, and ocean backscatter coefficient from which surface winds may be inferred. Since the measurement process is indirect, and the measurement environment is complicated by many factors affecting the instrument readings, corrections to the raw data are needed before they are used to compute geophysical parameters. These corrections are accomplished by the Seasat altimeter sensor file algorithms. The purpose of this paper is to describe these algorithms, why they are needed, how they are implemented, and the evaluation using in-flight data. (Author)

**A80-42067 *** **The Seasat scanning multichannel microwave radiometer /SMMR/ - Instrument description and performance.** E. G. Njoku, J. M. Stacey, and F. T. Barath (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 100-115. 18 refs. Contract No. NAS7-100.

The scanning multichannel microwave radiometer (SMMR) is an imaging 5-frequency radiometer flown on the Seasat and Nimbus-7 earth satellites launched in 1978. It measures dual-polarized microwave radiances from the earth's atmosphere and surface, primarily for the purpose of deriving global and nearly all-weather measurements of sea surface temperature, wind speed, and atmospheric liquid water and water vapor. This paper describes the SMMR instrument and its calibration, antenna pattern measurements, and data processing procedures. Analysis of early data from the Seasat SMMR shows that the expected engineering performance in flight was achieved, and the measurement of sea surface temperature and wind speed with accuracies of 1.5 K and 2 m/s, respectively, may be achievable once the geophysical data processing algorithms and analysis have been completed. (Author)

**A80-42068 *** **The Seasat scanning multichannel microwave radiometer /SMMR/ - Radiometric calibration algorithm development and performance.** P. N. Swanson and A. L. Riley (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 116-124. Contract No. NAS7-100.

Radiometric calibration algorithms for processing Seasat scanning multichannel microwave radiometer (SMMR) flight data are presented. An equation is derived which accounts for losses and reradiation in the microwave components and nonlinearities in the radiometer. The application of pre-launch calibration data to this derivation is described. A performance evaluation of the post-launch operation of the algorithm is presented, indicating temperature resolution of 0.63 K at 6.6 GHz and 1.39 K at 37 GHz. (Author)

**A80-42069 *** **The Seasat scanning multichannel microwave radiometer /SMMR/: Antenna pattern corrections - Development and implementation.** E. G. Njoku, E. J. Christensen, and R. E. Cofield (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 125-137. 17 refs. Contract No. NAS7-100.

The antenna temperatures measured by the Seasat scanning multichannel microwave radiometer (SMMR) differ from the true brightness temperatures of the observed scene due to antenna pattern effects, principally from antenna sidelobe contributions and cross-polarization coupling. To provide accurate brightness temperatures convenient for geophysical parameter retrievals the antenna temperatures are processed through a series of stages, collectively known as the antenna pattern correction (APC) algorithm. A description of the development and implementation of the APC algorithm is given, along with an error analysis of the resulting brightness temperatures. (Author)

**A80-42070 * #** **Seasat-A satellite scatterometer instrument evaluation.** J. W. Johnson, L. A. Williams, Jr., E. M. Bracalente, F. B. Beck, and W. L. Grantham (NASA, Langley Research Center, Hampton, Va.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 138-144. 12 refs.

The Seasat-A satellite scatterometer (SASS) was designed to measure ocean surface wind speed and direction in twenty-four independent cells over a 1000-km swath. It operated in the interrupted CW mode at a frequency of 14.6 GHz with four fan beam antennas and used Doppler filtering in the receiver for resolving the cells on the surface. The instrument began operating in space on July 6, 1978, and gathered normalized radar cross section data for approximately 2290 h. The purpose of this paper is to describe the in-orbit evaluation of the SASS hardware and its compatibility with the spacecraft. It has been determined that the scatterometer operated flawlessly throughout the mission, met all design requirements, and established a good data base for geophysical processing. (Author)

**A80-42071 *** **The SASS scattering coefficient algorithm.** E. M. Bracalente, W. L. Grantham (NASA, Langley Research Center, Hampton, Va.), D. H. Boggs (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and J. L. Sweet (Kentron International, Inc., Hampton, Va.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 145-154. 12 refs. Contract No. NAS7-100.

This paper describes the algorithms used to convert engineering unit data obtained from the Seasat-A satellite scatterometer (SASS) to radar scattering coefficients and associated supporting parameters. A description is given of the instrument receiver and related processing used by the scatterometer to measure signal power backscattered from the earth's surface. The applicable radar equation used for determining scattering coefficient is derived. Sample results of SASS data processed through current algorithm development facility (ADF) scattering coefficient algorithms are presented which include scattering coefficient values for both water and land surfaces. Scattering coefficient signatures for these two surface types are seen to have distinctly different characteristics. Scattering coefficient measurements of the Amazon rain forest indicate the usefulness of this type of data as a stable calibration reference target. (Author)

**A80-42072 *** **The Seasat-A synthetic aperture radar system.** R. L. Jordan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-5, Apr. 1980, p. 154-164. Contract No. NAS7-100.

The paper discusses the Seasat-A synthetic aperture radar system (SAR). The objective of this system was to detect ocean waves from orbital altitudes. A SAR system operating at 1275 MHz was designed to meet this objective; the choice of wavelength resulted from the imagery obtained by aircraft during 1972 to 1974 and the ease of implementation. The Seasat-A SAR system was turned-on in orbit on July 4, 1978, and gathered imagery until the spacecraft bus failed in orbit in Oct. 1978. The hardware including the antenna, the radar sensor, and data-link subsystem, and the SAR data processing subsystem are described; the radar performance including the SAR system error budget and various SAR imageries are presented, concluding that the performance of the Seasat-A SAR system met all of its parameters on at least some of the imagery. A.T.

**A80-43809 #** **Aperture synthesis with respect to microwave signals reflected from the sea surface (Sintezirovanie iskusstvennoi apertury po SVCh-radiosignalam, otrazhennym ot morskoi poverkhnosti).** B. S. Mush. *Radiotekhnika i Elektronika,* vol. 25, July 1980, p. 1426-1433. 9 refs. In Russian.

The theory of using synthetic-aperture radar to obtain images of the reflecting sea surface is examined. A formula is presented for calculating a reflecting-surface function which is a linear superposition of simple waves and those obtained by means of synthetic-aperture radar echo signals. These formulas lead to recommendations on the design of experiments aimed at investigating the properties of the sea surface. Experimental results are presented which confirm the theoretical calculations. B.J.

**N80-22757#** National Environmental Satellite Center, Washington, D. C.

**FUTURE UNITED STATES SATELLITE PROGRAMS OF INTEREST TO SNOW SCIENTISTS**

Donald R. Wiesnet 1979 7 p
Avail: NTIS HC A02/MF A01

Orbital parameters and sensor characteristics are described for the Heat Capacity Mapping Mission, LANDSAT C, Seasat A, Nimbus G, and the Tiros N satellites. Implications for snow studies using the new and improved sensors are discussed. A.R.H.

**N80-22758*#** Computer Sciences Corp., Wallops Island, Va.

**DETERMINING SEA-ICE BOUNDARIES AND ICE ROUGHNESS USING GEOS-3 ALTIMETER DATA**

R. E. Dwyer and R. H. Godin (NOAA, Washington, D. C.) Wallops Island, Va. NASA Wallops Flight Center Mar. 1980 49 p refs
(NASA-CR-156862) Avail: NTIS HC A03/MF A01 CSCL 08L

The GEOS-3 satellite and radar altimeter instrumentation are described, detailing the ice boundary discrimination technique utilized and presenting an analyses of the GEOS-3 data with respect to satellite visual and IR imagery. A brief description of the GEOS-3 real time data system is also given. E.D.K.

**N80-22759*#** National Aeronautics and Space Administration, Washington, D. C.

**PROGRAM FOR INTEGRATING MULTIZONAL PHOTOGRAPHS OF THE EARTH, TAKEN BY MKF-6 CAMERA, IN A COMPUTER**

A. V. Agapov and S. T. Mosin Jan. 1980 14 p Transl. into ENGLISH of "Programma Sovmeshcheniya v EVM Mnogozonalnykh Fotosnimkov Zemli, Poluchennykh Fotokamerami MKF-6", Rept. Pr-323 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-13 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Acad. of Sci. USSR, Kolosov
(Contract NASw-3199)
(NASA-TM-75701; Pr-323) Avail: NTIS HC A02/MF A01 CSCL 14E

An algorithm and program are described, for integrating up to 6 simultaneously exposed photographs in different spectral ranges of the surface of the Earth, taken by MKF-6 cameras aboard Soyuz-22. Three of the reference marks are identified on 1 photograph and then are used to integrate the other photographs with the first. The program was compiled for the ES-1040 computer, as a standard subprogram in a system for computer processing of data of study of the Earth from space. Author

**N80-23733*#** Department of Agriculture, Weslaco, Tex. Science and Education Administration.

**PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Dec. 1979 - 1 Mar. 1980**

Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Mar. 1980 9 p HCMM
(Contract NASA Order S-40198-B)
(E80-10106; NASA-CR-162817) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. HCMM day/night coverage 12 hours apart cannot be obtained at 26 deg N latitude, nor have any pairs 36 hours apart been obtained. A day-IR scene and a night scene for two different dates were analyzed. A profile across the test site for the same latitude shows that the two profiles are near mirror images of each other over land surfaces and that the temperature of two large water bodies, Falcon Reservoir and the Gulf of Mexico, are nearly identical on two dates. During the time interval between overpasses, the vegetative cover remained static due to winter dormancy. The data suggest that day/night temperature differences measured weeks apart may yield meaningful information about the contrast between daytime maximum and nighttime minimum temperatures for a given site.

**N80-23734*#** Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).

**APPLICATION EXPLORER MISSION A: HEAT CAPACITY MAPPING MISSION**

R. Haydn, Principal Investigator [1979] 3 p Sponsored by NASA HCMM
(E80-10107; NASA-CR-162818) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-25762*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**AN ALTERNATE ALGORITHM FOR CORRECTION OF THE SCANNING MULTICHANNEL MICROWAVE RADIOMETER POLARIZATION RADIANCES USING NIMBUS-7 OBSERVED DATA**

Per Gloersen, D. J. Cavalieri, and Harold V. Soule (OAO Corp., Beltsville, Md.) Apr. 1980 27 p refs Submitted for publication
(NASA-TM-80672) Avail: NTIS HC A03/MF A01 CSCL 14B

The manner in which Nimbus-7 scanning multichannel microwave radiometer (SMMR) scan radiance data was used to determine its operational characteristics is described. The predicted SMMR scan radiance was found to be in disagreement at all wavelengths with a large area of average measured ocean radiances. A modified model incorporating a different phase shift for each of the SMMR horizontal and vertical polarization channels was developed and found to provide good data correlation. Additional study is required to determine the validity and accuracy of this model. A.R.H.

**N80-25771#** National Technical Information Service, Springfield, Va.

**INSTRUMENTATION AND DATA PROCESSING USED IN EARTH RESOURCES TECHNOLOGY SATELLITES (ERTS), VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - 1979**

Audrey S. Hundemann Mar. 1980 244 p Supersedes NTIS/PS-79/0206; NTIS/PS-78/0070; NTIS/PS-77/0081
(PB80-805740; NTIS/PS-79/0206; NTIS/PS-78/0070; NTIS/PS-77/0081) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Abstracts are cited dealing with new or improved remote sensing techniques. Topic areas cover pattern recognition, spectrum analysis, image enhancement, photointerpretation, multispectral photography, and mapping. This updated bibliography contains 237 abstracts, 35 of which are new entries to the previous edition. GRA

**N80-26772#** National Environmental Satellite Service, Washington, D. C.
**DATA EXTRACTION AND CALIBRATION OF TIROS-N/NOAA RADIOMETERS**
Levin Lauritson, Gary J. Nelson, and Frank W. Porto Nov. 1979 80 p refs
(PB80-150824; NOAA-TM-NESS-107; NOAA-80010909) Avail: NTIS HC A05/MF A01 CSCL 22A

The TIROS N/NOAA series is the third generation of environmental satellites providing real-time data to direct readout users. Information is presented that enables users to extract from the telemetry streams data that are unique to a given sensor, to calibrate these data, and to develop an understanding of the accuracy and precision that can be expected of the calibrated data. GRA

**N80-26714*#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**A METHODOLOGY FOR DETERMINING OPTIMUM MICROWAVE REMOTE SENSOR PARAMETERS**
J. C. Holtzman, Principal Investigator and V. H. Kaupp Feb. 1980 200 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57918 ERTS
(Contract NAS9-15602)
(E80-10124; NASA-CR-160564; RSL-TR-380-1) Avail: NTIS HC A09/MF A01 CSCL 14B

**N80-26774*#** Toledo Univ., Ohio.
**NONLINEAR AEROELASTIC EQUATIONS OF MOTION OF TWISTED, NONUNIFORM, FLEXIBLE HORIZONTAL-AXIS WIND TURBINE BLADES Final Report**
Krishna Rao V. Kaza Jul. 1980 70 p refs
(Grant NsG-3139; Contract EX-76-I-01-1028)
(NASA-CR-159502; DOE/NASA/3139-1) Avail: NTIS HC A04/MF A01 CSCL 10A

The second-degree nonlinear equations of motion for a flexible, twisted, nonuniform, horizontal axis wind turbine blade were developed using Hamilton's principle. A mathematical ordering scheme which was consistent with the assumption of a slender beam was used to discard some higher-order elastic and inertial terms in the second-degree nonlinear equations. The blade aerodynamic loading which was employed accounted for both wind shear and tower shadow and was obtained from strip theory based on a quasi-steady approximation of two-dimensional, incompressible, unsteady, airfoil theory. The resulting equations had periodic coefficients and were suitable for determining the aeroelastic stability and response of large horizontal-axis wind turbine blades. R.E.S.

**N80-26776*#** Boeing Engineering and Construction, Seattle, Wash.
**MOD-2 WIND TURBINE SYSTEM CONCEPT AND PRELIMINARY DESIGN REPORT. VOLUME 2: DETAILED REPORT**
Jul. 1979 269 p
(Contracts DEN3-2; DE-A101-793T-20305)
(NASA-CR-159609; DOE/NASA-0002-80/2) Avail: NTIS HC A12/MF A01 CSCL 10A

The configuration development of the MOD-2 wind turbine system (WTS) is documented. The MOD-2 WTS project is a continuation of DOE programs to develop and achieve early commercialization of wind energy. The MOD-2 is design optimized for commercial production rates which, in multiunit installations, will be integrated into a utility power grid and achieve a cost of electricity at less than four cents per kilowatt hour. J.M.S.

**N80-27779*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SNOWPACK MONITORING IN NORTH AMERICA AND EURASIA USING PASSIVE MICROWAVE SATELLITE DATA**
J. L. Foster, A. Rango, and D. K. Hall [1980] 23 p refs Submitted for publication
(NASA-TM-80706) Avail: NTIS HC A02/MF A01 CSCL 08L

Areas of the Canadian high plains, the Montana and North Dakota high plains, and the steppes of central Russia were studied in an effort to determine the utility of spaceborne electrical scanning microwave radiometers (ESMR) for monitoring snow depths in different geographic areas. Significant regression relationships between snow depth and microwave brightness temperatures were developed for each of these homogeneous areas. In the areas investigated, Nimbus 6 (.081 cm) ESMR data produced higher correlations than Nimbus 5 (1.55 cm) ESMR data in relating microwave brightness temperature and snow depth from one area to another because different geographic areas are likely to have different snowpack conditions. L.F.M.

**N80-27781*#** National Aeronautics and Space Administration, Washington, D. C.
**THE HIGH VISIBLE RESOLUTION (HVR) INSTRUMENT OF THE SPOT GROUND OBSERVATION SATELLITE**
G. Otrio Apr. 1980 22 p Transl. into ENGLISH of conf. paper "L'Instrument a Haute Resolution Visible (HRV) du Satellite d'Observation de la Terre: Spot", Rept. IAF-79-F-239 Intern. Astronautical Federation, Munich, Sep. 1979 p 1-13 Presented at 30th Intern. Astronautical Federation, Munich, Sep. 1979 Original language document was announced as A79-53369 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Natl. Space Studies Center, Toulouse
(Contract NASw-3199)
(NASA-TM-75830; IAF-79-F-239) Avail: NTIS HC A02/MF A01 CSCL 20F

Two identical high resolution cameras, capable of attaining a track width of 116 km in an almost vertical line of sight from the two 60 km images of each instrument, will be carried on the initial mission of the space observation of Earth satellite (SPOT). Specifications for the instrument, including the telescope and CCD devices are summarized. The present status of development is described including the optical characteristics, structure and thermal control, detector assembly, elctronic equipment, and calibration. SPOT mission objectives include the developments relating to soil use, the exploration of EART Earth resources, the discrimination of plant species, and cartography. A.R.H.

**N80-27873*#** Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Space.
**ASSESSMENT OF ATMOSPHERIC HEIGHT UNCERTAINTIES FOR HIGH PRECISION SATELLITE ALTIMETER MISSIONS TO MONITOR OCEAN CURRENTS**
Julius Goldhirsh and John R. Rowland Jun. 1980 73 p refs
(Contract NASA Order P-78192; Contract N00024-78-C-5384)
(NASA-CR-156868; JHU/APL-SIR80U-018) Avail: NTIS HC A04/MF A01 CSCL 04A

The influence of the atmosphere on nadir directed signal associated with satellite altimeters are examined. Frequencies at 6, 13.5, and 35 GHz are selected so as to provide a parameter study. Uncertainties are summarized in both existing and proposed techniques which establish ionospheric and tropospheric height corrections. The error summary thus gives values describing the best you can do in height resolution (as dictated by atmospheric parameters) for a satellite borne altimeter system. The results presented reflect data gleaned from the literature, at large, as well as from the existing body of published literature associated with the Seasat A Altimeter Experiment. Specifically considered are: (1) the effects of precipitation on altimeter signals, (2) range errors due to refractive index variations in both the clear atmosphere (convective and nonconvective) and clouds, and (3) range errors introduced by the ionosphere. A preliminary analysis is pursued establishing the feasibility of incorporating rain rate range gates in a future satellite-borne altimeter system. F.O.S.

## 09

## GENERAL

**Includes economic analysis.**

**A80-34523** **Thorny questions over remote sensing.** S. Yanchinski. *New Scientist*, vol. 86, Apr. 17, 1980, p. 150-152.

Consideration is given to problems associated with the use and reception of expensive remote sensing data by developing nations. Questions of access to sensitive information acquired by satellite, the costs involved in installing, operating and maintaining satellite ground stations by nations desiring exclusive information, the training of remote sensing interpreters in developing nations, the true value of Landsat data in resource evaluation and other applications, the use of regional ground receiving stations, costs associated with the updating of ground facilities and the present incompatibility of Landsat systems with the French SPOT remote sensing satellite are discussed. It is suggested that the best solution may prove to be the launching of additional remote sensing satellites by the wealthier or more advanced of the developing nations. A.L.W.

**A80-34527** # **Remote sensing activities in the Netherlands (Remote sensing aktiviteiten in Nederland).** R. van Konijnenburg (Rijkswaterstaat, Meetkundige Dienst, Netherlands). *Ruimtevaart*, vol. 29, Feb. 1980, p. 9-14. In Dutch.

The Netherlands remote sensing technology applications program (NIWARS) is described. Attention is given to the development of sensors (SLAR, IR scanners, etc.), and to the participation of various Netherlands organizations in the remote sensing effort. B.J.

**A80-34528** # **The possibility of using a Netherlands remote sensing satellite for the needs of developing countries (Toepassingsmogelijkheden van een Nederlandse remote sensing satelliet ten behoeve van de ontwikkelingslanden).** A. Rosema and J. H. Bijleveld (Engineering Consultants Environmental Analysis and Remote Sensing, Delft, Netherlands). *Ruimtevaart*, vol. 29, Feb. 1980, p. 15-23. In Dutch.

**A80-36319** # **Earth observation - Issues and perspectives /The Theodore von Karman Lecture/.** D. J. Fink (General Electric Co., Fairfield, Conn.). *American Institute of Aeronautics and Astronautics, International Meeting and Technical Display on Global Technology 2000, Baltimore, Md., May 6-8, 1980, Paper 80-0930.* 56 p. 32 refs.

The acquisition, transmission, processing and dissemination of earth observation data from space platforms are analyzed, and the potential of space-borne earth observation is assessed. Following a brief review of the historical development of earth observation from airborne, rocket and space platforms using cameras and other sensors, the significant programs which influenced the direction and progress of space technology for earth observation are considered, including the TIROS, Gemini and Landsat programs. Applications of space-borne cloud and land imagery, ground receiving stations, and geostationary platforms in oceanography, meteorology, climate studies, magnetic sensing and land observation are illustrated with photographs, and the various users of this information are indicated. The systems and technology involved in earth observation from space are analyzed, with attention given to system design to meet mission and user requirements, sensing, communications, data processing and information extraction technology, and future system trends. Perspectives are presented on the achievements of earth observation programs, and cost-benefit, technical and institutional issues limiting the advance of earth observation applications are identified. A.L.W.

**A80-36964** # **Shuttle era opportunities in earth resources rationalization.** C. T. N. Paludan (Tennessee, University, Tullahoma, Tenn.). In: Shuttle to the next space age; Proceedings of the Southeast Seminar for Reporters and Teachers, Huntsville, Ala., July 18, 19, 1979. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 57-61. 9 refs. (AIAA 79-3071)

Remote sensing results have already proven useful in rationalizing the utilization of scarce resources. The stage is now set for international cooperation in the management of the world's resources. The Space Transportation System will play an important role in getting instruments and communications items into orbit; the Shuttle provides an opportunity for the use of large complex instruments, including the Large Format Camera and the Shuttle Imaging Radar. B.J.

**A80-38207** # **Landsat D: Case study in spacecraft design.** B. T. Bachofer (General Electric Co., Space Div., Philadelphia, Pa.). New York, American Institute of Aeronautics and Astronautics, Inc., 1979. 171 p. $12.50.

The Landsat D project is intended to apply remotely sensed data from space to the management of the earth's resources, utilizing the thematic mapper, a seven spectral band, mechanically scanned radiometer with 30-m spatial resolution. The flight system design of Landsat D is discussed in detail, with attention given to thermal control and flight software. In addition, communication design is considered, including wideband and narrowband communication subsystems and antenna and transmitter power levels, as well as the electrical system design, including solar array size, battery selection, power distribution and protection, and command and telemetry distribution. J.P.B.

**A80-38786** **Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings (Applicazioni del telerilevamento dallo spazio; Convegno Scientifico Internazionale sullo Spazio, 20th, Rome, Italy, March 11-13, 1980, Atti).** Conference sponsored by the Ministero degli Affari Esteri, ESA, Associazione Industrie Aerospaziali, et al. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980. 425 p. In Italian, English, and French.

Applications of spaceborne remote sensing and ranging systems are discussed in terms of orbiting systems, and the reception, processing and utilization of data; technical and economic aspects are also addressed. Topics include the operation of the microwave remote sensing experiment, the lidar air transport system for geophysical and atmospheric experiments, and applications of remote sensing in the agricultural field. Also presented are a mathematical model for thermal inertia mapping by infrared imagery, the determination of chlorophyll concentration in the sea from the Nimbus-7 coastal zone color scanner, the measurement of evapotranspiration by means of surface temperature, and electronic photointerpretation using digital processing for applications in structural geology. J.P.B.

**A80-38787** # **The earth observation programme of the European Space Agency.** M. Trella and J. Louet (ESA, Paris, France). In: Applications of remote sensing and ranging systems from space; International Scientitic Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 13-37.

The activities of the European Space Agency with regard to earth observation from space are summarized. Attention is given to missions for the next decade, including a meteorological program concerned mainly with setting up an operational service provided by a series of Meteosat satellites. Also considered are a European remote sensing program for the monitoring and analysis of land, coastal, ocean and polar regions, and an earth-oriented science program on climatology and geodynamics-geodesy. Data processing and dissemination are also discussed, along with platforms for the collection of in situ data. J.P.B.

**A80-38806** # **The Earthnet program - Experiences and prospects (Il programma Earthnet - Esperienze e prospettive).** L. Marelli (ESA, Frascati, Italy). In: Applications of remote sensing and ranging systems from space; International Scientific Conference on Space, 20th, Rome, Italy, March 11-13, 1980, Proceedings. (A80-38786 16-43) Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1980, p. 261-270. In Italian.

The operation of Earthnet's receiving and preprocessing facilities is summarized. The program consists of S-band stations throughout Europe and utilizes the optical processing of synthetic aperture radar data; standard digital and photographic products are used. Attention is given to the acquisition function and the problem of archiving remotely sensed data, the preprocessing function, considering geometric and radiometric system corrections, the distribution function, and the evolution of the use of the remotely sensed data. J.P.B.

**A80-39742** **The ESA remote sensing programme.** J. Plevin (ESA, Directorate of Planning and Future Programmes, Paris, France) and C. Honvault (ESA, Directorate of Applications Programmes, Toulouse, France). *International Journal of Remote Sensing*, vol. 1, Jan.-Mar. 1980, p. 53-67. 7 refs.

The major European activities in the field of spaceborne remote sensing are outlined. The overall objectives of European remote sensing satellite systems are indicated, and the Earthnet satellite remote sensing data network is outlined. Attention is given to the Metric Camera and Microwave Remote Sensing Experiment to be flown aboard the first Spacelab mission, and to system feasibility studies and development activities for a satellite-borne SAR and the Land Application Satellite System and the Coastal Ocean Monitoring Satellite System. The importance of developing applications demonstrations is considered. It is concluded that remote sensing satellites will form an important part of the future ESA space program, with implementation by the mid-1980s. A.L.W.

**A80-40464** **Isro - India's ambitious space agency.** D. Velupillai. *Flight International*, vol. 117, June 28, 1980, p. 1466-1470.

India's space program is described in terms of developments in communications as well as earth observation for natural resources management. Attention is given to the SLV-3 orbital launcher and the flight-test instrumentation payload. The Ariane passenger payload experiment which is to be launched from India as a test communications satellite is also described. Emphasis is placed on the combined communications and meteorological satellite system, Insat. J.P.B.

**A80-41290** # **The structure of a space system for the sensing of earth resources (Struktura kosmicheskoi sistemy izucheniia prirodnykh resursov zemli).** Iu. P. Kienko (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, USSR). *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1980, p. 5-10. In Russian.

A Soviet system for the remote sensing of earth resources is discussed. The system incorporates Salyut orbital stations, Cosmos satellites, Meteor satellites, AN-30 airborne laboratories, test sites, and data processing systems. B.J.

**A80-41299** # **Remote sensing activities in France (Raboty po distantsionnomu zondirovaniiu vo Frantsii).** A. Iu. Kholmovskii. *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1980, p. 92-102. 16 refs. In Russian.

The remote sensing program of France can be divided into two parts: (1) that based on Landsat and (2) aerial thermographic and multispectral surveys conducted without foreign assistance. This paper reviews the French remote sensing program with attention given to sensor systems and image processing techniques. Various specific projects are briefly discussed, including FRALIT, ARNICA, PYRALP, GOLION, POLUMER, and AGREST. B.J.

**A80-41301** **Remote sensing of earth resources. Volume 7 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1978, Technical Papers.** Edited by F. Shahrokhi (Tennessee, University, Tullahoma, Tenn.). Tullahoma, Tenn., University of Tennessee, 1980. 348 p.

The latest advances in the field of remote sensing of earth resources are discussed with particular reference to problems involving computer-controlled and manual systems for interpreting multi-spectral photography and scanner data as well as sensor technology, information applications and data flow schemes. Papers are presented on low-cost image displays using computer graphics techniques, forest cover mapping from Landsat imagery, application of remote sensing to estimating soil erosion potential, and determination of the properties of a powerplant plume by aircraft and spacecraft measurements. V.L.

**A80-41662** **Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers.** Edited by F. Shahrokhi and T. Paludan (Tennessee, University, Tullahoma, Tenn.). Tullahoma, Tenn., University of Tennessee, 1980. 379 p.

Topical problems involving computer-controlled and manual systems for interpreting multispectral photography, and scanner data are discussed along with sensor technology, information applications, and data flow schemes. Particular consideration is given to site-specific mapping of surface temperature based on NOAA-5 satellite VHRR data, digital resampling of Landsat forest imagery for multidate registration, estimation of vegetation biomass in bunch-grass rangelands of Alberta using Landsat imagery, and the applicability of Landsat imagery for mapping soils in arid and semiarid regions. B.J.

**A80-41663** * **Technology transfer of remote sensing technology.** A. D. Smith (NASA, Marshall Space Flight Center, Huntsville, Ala.). In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 1-8.

The basic philosophy and some current activities of MSFC Technology Transfer with regard to remote sensing technology are briefly reviewed. Among the problems that may be alleviated through such technology transfer are the scarcity of energy and mineral resources, the alteration of the environment by man, unpredictable natural disasters, and the effect of unanticipated climatic change on agricultural productivity. B.J.

**A80-41681** **End-to-end data/information system concept - The solution or the problem.** C. E. Catoe. In: Remote sensing of earth resources. Volume 8 - Annual Remote Sensing of Earth Resources Conference, 7th, Tullahoma, Tenn., March 27-29, 1979, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1980, p. 323-372. 67 refs.

In order to alleviate the data management problems associated with the efficient and cost-effective handling of information, NASA is embarking on the development of a total end-to-end information system, which will involve everything from the sensing of an event to the processing and information and its delivery to the user. In this paper the various elements that make up the total end-to-end system are examined in order to determine how they interrelate and how they impact the operational needs of the user community. It is noted that the major current limitation to the successful implementation of the end-to-end system concept is the uneven readiness of the system elements. B.J.

**A80-42859** **Earth observation - Cooperative mission or competitive venture.** L. Warzecha (General Electric Co., Space Div., Philadelphia, Pa.). In: Space - New opportunities for international ventures; Proceedings of the Seventeenth Goddard Memorial Symposium, Washington, D.C., March 28-30, 1979. San Diego, Calif., American Astronautical Society; Univelt, Inc., 1980, p. 175-192. (AAS 79-061)

Aspects of international cooperation and competition in earth observation from space are considered. Attention is given to advantages of cooperation, earth observation missions (e.g., meteorological, resource management, oceanographic, environmental, thermal, and geophysical), issues in international remote sensing, technical issues, political issues, economic issues, and courses of possible action. B.J.

**A80-43476 *** **Integrated use of Landsat data for state resource management.** W. G. Schneider, Jr. Research supported by NASA; Contract No. NASw-3140. Lexington, Ky., Council of State Governments, 1979. 41 p. 6 refs. $4.00.

The study deals with the integration of a practical information resource - data from the earth orbiting satellite Landsat - with alternate forms of data to structure a state resource data base. State use of Landsat data within a comprehensive resource management scheme is examined. The efforts of NASA in the transfer of this space technology to state resource management applications are outlined. The role two nongovernmental sectors, universities and private industry, play in assisting states to develop Landsat data analysis capability is described. V.T.

**N80-22760*#** National Aeronautics and Space Administration, Washington, D. C.
**THE SOPHIA-ANTIPOLIS CONFERENCE: GENERAL PRESENTATION AND BASIC DOCUMENTS**
Mar. 1980 50 p Transl. into ENGLISH of conf. paper from CNES, Operation Pilote Interministerielle de Teledetection, Paris Conf. held at Paris, Feb. 1980 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76132) Avail: NTIS HC A03/MF A01 CSCL 05A

The procedures and techniques used in NASA's aerospace technology transfer program are reviewed for consideration in establishing priorities and bases for joint action by technicians and users of remotely sensed data in France. Particular emphasis is given to remote sensing in agriculture, forestry, water resources, environment management, and urban research. A.R.H.

**N80-23719*#** National Governors Association/Council of State Planning Agencies, Washington, D. C.
**EARTH RESOURCES DATA PROJECT Final Report, 1 Aug. - 30 Sep. 1979**
Feb. 1980 96 p ERTS
(Contract NASw-3140)
(E80-10092; NASA-CR-162802) Avail: NTIS HC A05/MF A01 CSCL 05B

**N80-25273#** Finnish National Committee of COSPAR, Otaniem.
**SPACE ACTIVITIES IN FINLAND IN 1978 Annual Report**
M. Tiuri, ed. and S. Urpo, ed. 1978 11 p refs Prepared in cooperation with Helsinki Univ. of Technology, Espoo
Avail: NTIS HC A02/MF A01

Finnish space programs completed in 1978 or in progress are reviewed. These include soil mapping, land use mapping, and terrain analysis all from LANDSAT data as well as forest mapping, small scale mapping, and ore prospecting (aircraft scanner data). Finnish involvement in the Intelsat, Eutelsat, Sirio, and OTS satellite programs is also discussed. The work of Finnish satellite tracking, telemetry, and acquisition facilities is covered. Author (ESA)

**N80-27914*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**METEOROLOGICAL SATELLITES**
Lewis J. Allison, ed., Abraham Schnapf (RCA Corp.), Bernard C. Diesen, III (USAF), Philip S. Martin (USAF), Arthur Schwalb (NOAA), and William R. Bandeen Jun. 1980 78 p refs Submitted for publication
(NASA-TM-80704) Avail: NTIS HC A05/MF A01 CSCL 04B

An overview is presented of the meteorological satellite programs that have been evolving from 1958 to the present, and plans for the future meteorological and environmental satellite systems that are scheduled to be placed into service in the early 1980's are reviewed. The development of the TIROS family of weather satellites, including TIROS, ESSA, ITOS/NOAA, and the present TIROS-N (the third generation operational system) is summarized. The contribution of the Nimbus and ATS technology satellites to the development of the operational-orbiting and geostationary satellites is discussed. Included are descriptions of both the TIROS-N and the DMSP payloads currently under development to assure a continued and orderly growth of these systems into the 1980's. Author

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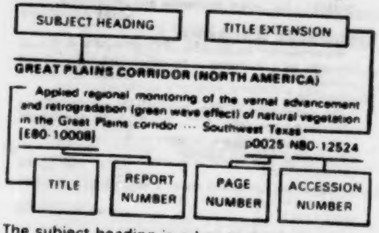
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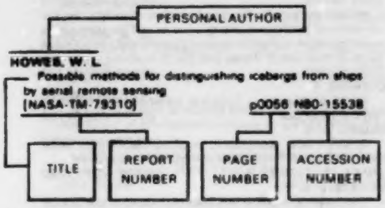

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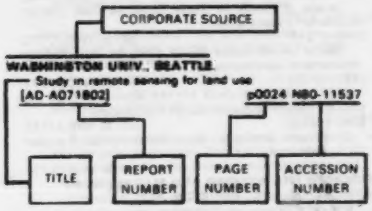

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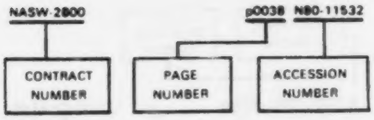

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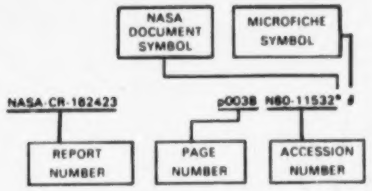

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15. Supplementary Notes

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This bibliography lists 337 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1980 and September 30, 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

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